SELECTIONS

FROM

THE RECORDS

OF THE

GOVERNMENT OF INDIA,

(HOME DEPARTMENT.)

Published by Authority.

SUPPLEMENT

TO

SELECTIONS N°. VIII.

Papers

REGARDING THE

FORESTS AND IRON MINES IN KUMAON.

Calcutta:

THOS. JONES, "CALCUTTA GAZETTE" OFFICE.

1855.

Papers

REGARDING THE

FORESTS AND IRON MINES IN KUMAON.

No. 887.

FROM

C. BEADON, ESQUIRE,
Secy. to the Govt. of India,

To

THE SECY. TO THE GOVT. OF THE N. W. PROVINCES.

Dated the 13th July 1855.

HOME DEPARTMENT.

SIR,

IN transmitting to you the accompanying ten printed copies of the Report furnished by Mr. Henwood, the Mineral Surveyor, "on the metalliferous deposits of Kumaon and Gurhwal," I am directed to state, that in the opinion of the Hon'ble the President in Council the time has arrived when the operations of the party left by Mr. Henwood in Kumaon, for the purpose of carrying on experiments in mining and smelting iron, should be placed under the direct control of the Commissioner of Kumaon, Mr. Batten, who has already afforded them valuable assistance. His Honor in Council is also of opinion, that the general control of the undertaking should be in the hands of the Government of the North-Western Provinces, which, under any circumstances, would be better able to direct its progress and judge of its results than the Supreme Government in Calcutta; and which, from the circumstance of the Lieutenant-Governor residing some part of the year at Nynee Tal, and enjoying facilities of constant personal communication with the gentlemen engaged in the undertaking and with the local authorities, is peculiarly well situated for the charge.

2. Mr. Barratt, who is now in charge of the mining operations, (Mr. Henwood having finished his engagement and returned to England,) has accordingly this day been directed to make all his Reports, and

address all his requisitions to the Commissioner of Kumaon, and instead of referring in cases of difficulty (as he has been enjoined to do by Mr. Henwood), to the Government of India, to look for orders and instructions from the Government of the North-Western Provinces. The necessary intimation of this proposed change of practice has been made to the Commissioner of Kumaon direct, and you will be pleased, under the orders of the Hon'ble the Lieutenant-Governor, to give him such further instructions for his guidance as may appear proper.

3. Mr. Henwood recommends that a model mining experiment be carried on at Burralgaon, in the valley of the Ramgunga, which he states "possesses collective advantages which we found nowhere else, and which make it the fittest place for the experiment." This has already been approved by the Government of India, as you were informed by the communication from this Department, No. 750, dated the 8th ultimo.

4. It will be seen from Mr. Henwood's Report (p. 38,) that Mr. Davies, one of his Assistants, who is a smelter and not a miner, "agrees with Lieut.-Colonel Drummond in thinking the experiment can best be made in the yet undeveloped District and pestilent climate of the Bhabur;" but whether this view be correct or not, His Honor in Council is of opinion that the Government should, at all events, in the first instance, be guided by the advice of Mr. Henwood.

5. Mr. Davies is desirous (see page 40 of Report) of erecting a large furnace 8 feet in diameter and 30 feet high for regular work, and one of 4 feet in diameter and 20 feet in height for trying experiments, each to be worked by means of four circular bellows driven by a water-wheel. Mr. Henwood considers that furnaces of such size, and blowing apparatus of such a description, are far more costly than is at all necessary, and far beyond Mr. Davies's skill to plan and ability to execute; and with the full concurrence of Messrs. Barratt and Gray, his other Assistants, he recommends the construction of a blast furnace of about 3½ feet in diameter and from 12 to 16 feet high, to be blown by means of a fall of water into a pneumatic trough through a wooden tube. This kind of blast Messrs. Barratt and Gray can undertake, and Mr. Davies can assist them in making it. It seems to His Honor in Council most prudent in every way to act on the recommendation of Mr. Henwood, and to sanction his proposals.

6. The cost of erecting the works on Mr. Henwood's plan is estimated at £1,000, besides implements and stores. The cost of the ore and

charcoal necessary to produce a ton metal is taken at £2-5-6, and the value of a ton of metal is £20 : a furnace of the dimensions proposed will produce about a ton a day. Although therefore there will be no great profit from the operations, it seems likely that a large proportion of the outlay incurred in the experiment will be repaid.

7. His Honor in Council accordingly authorizes the Hon'ble the Lieutenant-Governor to sanction any reasonable outlay for the mining and smelting operations to be carried on at Burralgaon, and when the works are completed there, and the operations fairly set a-going, His Honor in Council will be happy to receive and consider any suggestion which the Lieutenant-Governor may feel disposed to make for the establishment of similar works at some other place, either in the Bhabur or elsewhere, wherever the prospects seem on the whole to be most encouraging.

8. At the close of the season 1855-56, the Government of India will expect to be furnished with a complete Report of the Government mining operations in Kumaon, with a statement of their actual and probable results, financial, economical and otherwise (more particularly as regards their effect in leading the native miners to adopt a more scientific mode of working the mines and in inducing capitalists to turn their attention to the subject,) and with such suggestions, either for continuing or discontinuing these operations, as the circumstances may seem to require.

9. In my letter No. 509, dated the 12th April last, the attention of the Hon'ble the Lieutenant-Governor was drawn to Mr. Henwood's representations regarding the wanton destruction of the forests, with a view to the adoption of such measures as might be considered necessary for the prevention of the evil. I am again instructed especially to solicit the attention of His Honor to this subject, with reference to Mr. Henwood's remarks at pages 30 to 33 and 35 and 36 of his Report, and to suggest the urgent necessity for adopting measures to preserve and perpetuate the forests in the mining districts of Kumaon and Gurhwal, and to extend them by new plantations in the neighbourhood of the best iron mines. It is obviously useless to plant young trees in any place from which all people and cattle are not rigorously excluded.

10. I am also directed to request that the Hon'ble the Lieutenant-Governor will consider the terms on which the iron mines in Kumaon

and Gurhwal are now worked, and what modifications it may be necessary to adopt, in order to encourage the production of iron on a much larger scale, either by native miners or by the more powerful agency of a company under European management and direction. For an object of such extreme importance it may be necessary not only to remit the small amount of revenue derived from the mines, but to offer large rewards for the successful produce of metal.

11. Copies of the Hon'ble Court's despatches, Nos. 46 and 74 of 1854, regarding the engagement of Messrs. Henwood, Barratt, Gray and Davies, were communicated to you with my letter No. 55, dated the 12th January last. The covenants entered into with Messrs. Barratt, Gray and Davies are herein enclosed for the information of the Hon'ble the Lieutenant-Governor, and I am directed to draw the attention of His Honor to the 4th paragraph of my letter to Mr. Henwood, dated the 8th ultimo (a copy of which was communicated to you by endorsement No. 750 of the same date,) sanctioning the grant of Rupees 10 a month for horse allowance to Messrs. Barratt and Gray, and while travelling, an additional allowance of Rupees 100 a month to each for expenses, in lieu of all other charges. A similar arrangement might be made with Mr. Davies.

12. Mr. Henwood, before leaving India, submitted a proposal to the Government of India to dispense with Mr. Davies's services, as he considered him perfectly useless, and to procure another smelter from England. Circumstances have occurred to render it probable, that Mr. Henwood may have been somewhat prejudiced against Mr. Davies, who has certainly behaved towards him in an insubordinate and unfair manner, but who is nevertheless thought by others to possess knowledge and experience in his particular profession, and who was originally selected by Mr. Henwood himself; His Honor in Council is not therefore prepared to dispense with Mr. Davies' services at once, but I am desired to request that he may be employed under the exclusive and entire direction of Mr. Barratt, who should be required to report upon his conduct and proceedings after three months. The Hon'ble the Lieutenant-Governor will then, on the Commissioner's Report, be in a position to determine whether Mr. Davies may with most advantage be retained or dispensed with.

13. In conclusion I am directed to transmit a copy of a letter of the 30th ultimo from Mr. Henwood, in which he mentions the discovery of

two new mines in Chowghurka, which have been visited by Messrs. Barratt and Gray. His Honor the Lieutenant-Governor will pass such orders as may appear to him necessary in respect to the exploring of these mines.

I have the honor to be, &c.,
(Signed) C. BEADON,
Secy. to the Govt. of India.

No. 1718 A. of 1855.

From

WILLIAM MUIR, Esquire,
Secy. to the Govt. of the North-Western Provinces,

To

CECIL BEADON, Esquire,
Secy. to the Govt. of India, Home Department,
Fort William.

Dated Head Quarters, Nynee Tal,
The 13th August 1855.

Revenue Department.

Sir,

With reference to the several remarks and instructions which have been communicated by the Supreme Government on the subject of the preservation of the forests in the Kumaon and Gurhwal Districts, I am directed by the Hon'ble the Lieutenant-Governor to forward to you, for submission to the Hon'ble the President in Council, the accompanying copy of a letter from the Commissioner of Kumaon, No. 258, dated the 6th instant, with the Reports of the District Officers on the subject.

2. The Lieutenant-Governor does not doubt that the views unanimously expressed by the authorities of the Province are sound and accurate. He is satisfied that, for mining operations on any extensive scale, the supplies of fuel, both within the hills and on their borders towards the plains, will be found to be abundant for a long course of years. The limited measures referred to by the Commissioner, in his 6th and 7th paras., may be adopted without objection, and authority will be given to him for the purpose; but they will, in truth, be of but little practical importance.

3. The settlement engagements in Kumaon, it should be stated, reserved to the Government the right of taking possession of *uncleared* forests and other tracts lying within the declared village areas.

4. The Lieutenant-Governor would request that copies of the present papers should be made public together with Mr. Henwood's Report.

I have, &c.,

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

No. 1 in No. 1718 A. of 1855.

No. 258 of 1855.

From

J. H. BATTEN, Esquire,

Commissioner, Kumaon Division,

To

W. MUIR, Esquire,

Secy. to the Govt. of the North-Western Provinces.

Dated Nynee Tal, the 6th August 1855.

General Department.

Sir,

With reference to your letter No. 891 A., dated the 28th April last, I have now the honor to forward, for the information of the Hon'ble the Lieutenant-Governor, the accompanying Reports of the District Officers in Kumaon and Gurhwal, on the subject of fuel for mining operations, and of the conservation generally of the forests, to the destruction of which Mr. Henwood, late Mineral Surveyor in Kumaon, so forcibly alludes in his Report (your enclosure.)

2. Mr. J. Strachey, Collector and Magistrate of Moradabad, and formerly Senior Assistant in Gurhwal, has favored me, at my request, with his own separate minute on the subject under discussion, and I solicit the particular attention of His Honor to that paper, because it embodies in a great measure my own deliberately formed opinions.

3. In the neighbourhood of the iron mines, especially at Khetsaree, the miners have undoubtedly made great havoc among the forests of pine *(Pinus Longifolia Cheer,)* which have hitherto been exclusively used for charcoal-burning; and the near vicinity of the mines has been, as Mr. Henwood truly observes, greatly denuded. I however quite agree with

Mr. Strachey in attributing this local devastation to the pettiness of our mining and smelting operations. Native furnaces would be unable to deal with charcoal made from oak and other hard woods, and the tender branches of pine have hitherto supplied all wants. Moreover, the operations at the mines have been on such a comparatively-speaking small scale, that the women and children belonging to the smelters have been able to produce all the fuel required from their daily visits to the forests in the immediate vicinity of the furnaces. Under a system of big machinery and extensive out-turning of iron, a market for fuel would be created, and the villagers bordering on the remoter and more extensive forests, both of pine and oak, would soon see the profit of stacking wood near their homes and selling charcoal according to the demand at the mines. Pine, too, would cease to be the sole fuel, and more of each tree would be used in the charcoal-burning, instead of, as at present, only a few of its tenderer parts. Mr. Strachey's remarks as to the supply of fire-wood at Almorah are peculiarly apposite.

4. In regard to the general subject of forests in this Province, independent of the *immediate* neighbourhood of the larger mines and of the tracts which may be assumed to have never been thickly wooded, I venture, in opposition to the apparent opinion of Mr. Henwood—at all events, to the impression which, I think, the Report of that gentleman would leave on the public mind—to declare that the forests of Kumaon and Gurhwal are boundless, and, to all appearance, unexhaustible; and that they require no human care to preserve them; while, on the other hand, every encouragement ought to be given to their diminution for the sake of the inhabitants, who, in many places, have now to maintain a constant war (not always successful) against wild beasts, both those that destroy life and those that destroy food.

5. The prevention of fire and cattle-grazing (for which firing the forest grounds is a necessity) and the planting of trees are the remedies for the evils complained of by Mr. Henwood, which that gentleman points out. I am afraid that no amount of authoritative prohibitions can prevent the conflagrations in the forest, which, except in very dry seasons, like the last, are confined to the grass and do not injure the trees. The passing of a torch at night, a spark from a hookah, may cause, in May and June, a fire which will spread over hundreds of square miles. Moreover, no good object would be attained by the prohibition of fires, except in any forest which may be preserved for special fuel near mines, and even

there accidental fires could not always be avoided. The mere manufacture of charcoal may be expected to cause a considerable amount of unpreventable conflagration. Of course, if any forest or plantation of *young* trees is to be preserved for purposes of fuel, all cattle grazing and goat pasturing must be rigidly stopped. Ten goats or sheep will do more harm than a hundred fires of ordinary seasons. I consider plantations of seedling trees, taken from nurseries, to be an absolute impossibility. If made on flat ground, with easy means of watering, cultivation must be put an end to in the very places where it is most profitable, and the supply of food to the inhabitants must be proportionably diminished, and probably pine plantations would not succeed in such situations; while to plant oaks there would be an useless waste of time and labour. The oak forests, in all places where that wood grows naturally and easily, may almost, without exaggeration, be said to be untouched, and, if touched by periodical clearings of new ground for tillage, Nature bountifully (too bountifully indeed) renews the tree vegetation in the abandoned grounds. On bare hill-sides, the preservation of planted-out pine trees could not be effected without an army of watchmen, attended by another army of water-carriers *(bheesties)*; and even with the latter in daily attendance, my own experience leads me to doubt whether cheer pine-trees will in these hills grow in artificial plantations. It is difficult in a small garden, with every means of watering at hand, to show a good-sized cheer tree after ten years of care. On the other hand, one wild plot of cheer trees, so long as only three or four old cone-bearing trees are left undestroyed, will present a larger supply of wood on the barrenest hill-side than twenty plots of planted trees would show, after many years of labour and expense. Even at Khetsaree such wild plots still exist, especially on the spur separating Khetsaree from Kooneegarh, and is worth, at the present time, without any expense to Government, more than any plantation of an artificial nature, kept up at a great cost, would produce for the benefit of our *grand-children.*

6. *My own* measures for preserving such forests of the neighbourhood *of the mines* as may have escaped devastation would be the same as those proposed by Captain Ramsay in his Report. The landholders do not now interfere with the charcoal-burners, neither will they interfere with Government; and in Kumaon the people are accustomed to obey the orders of authority. I would recommend that a rough examination be at once made of all forests and patches of forest existing with-

in 5 or 6 miles of *Khetsaree* and *Ramgurh* iron mines (*vide* Mr. Henwood's Report concerning these localities,) and that, until we have before us a tolerably accurate estimate of the fuel existing within those circles, *all* charcoal-burning, and all felling of trees, except by zemindars under license, purely for purpose of house-building, be prohibited by proclamation and by notice to the Government putwarries. If necessary, the leasing of the iron mines at Khetsaree might be suspended for one year, but if leases are granted, a condition might be made that no charcoal is to be manufactured within five miles. After we obtain our information as to the existing and *still saved* fuel, measures can then be taken for setting apart the plots of forest as Government property, and if required, forest-rangers might be appointed, *beyond five miles*, in the greater part of Ramgurh, where iron is worked; and in the Khetsaree and Semul Khet District, I have no hesitation in stating, that the forest is boundless from Ramgurh extending to the plains, and from Khetsaree (the Ramgunga valley) to the Pindur on one side (the East) and to the Aluknunda on the other (the North-west.) In the latter locality, too, the Jourassee and Nugarjun ranges on the South-west and South still present a considerable area of pine forest, and if the old trees still standing are saved from the axe, the forest will continually renew itself, as fast as the young and middle-aged trees disappear under the smelting operations.

7. I entirely concur in the opinion of Mr. Strachey, that the Deodar groves and few wild woods of that noble tree should be *preserved;* without that measure, bridge buildings will soon become impossible in Kumaon and Gurhwal. Fortunately, the people themselves venerate the Deodar, and will aid in its conservation.

8. In conclusion, although my particular attention has not in the letter under acknowledgment been called to the subject of the Bhabur forests, I think it my duty to state *emphatically* that Mr. Henwood, in his final Report, is, I must say, unaccountably incorrect in his low estimate of the *fuel* capabilities at Dechour and elsewhere. Assuming that saul wood is not to be touched as fuel, I fully believe that the lower hills and Bhabur, at every iron locality (discovered last season by Colonel Drummond,) can supply sufficient charcoal for the largest English furnace for a hundred years to come; and that the forests are self-renewable, without limits in that climate. His Honor will peruse Mr. Strachey's remark on this point. I cannot help thinking that the Govern-

ment of India should at once be solicited to address the Hon'ble Court, and to beg that Mr. Henwood's Report shall not be *published* until the contradictory statements on the subject of fuel shall be made equally public. I highly value Mr. Henwood's Report as a whole, but that eminent gentleman had not time and opportunity sufficient to enable him to form an *universally* accurate judgment *on all* points which his Report so ably discusses.

I have, &c.,

(Signed) J. H. BATTEN,

Commissioner.

No. 2 in No. 1718 A. of 1855.

No. 51 of 1855.

From

Captain H. RAMSAY,

Senior Assistant Commissioner,

Kumaon Proper,

To

J. H. BATTEN, Esquire,

Commissioner of the Kumaon Division.

Dated Camp Nynee Tal, the 30th June 1855.

Sir,

I have the honor to acknowledge the receipt of your letter No. 167, dated 3rd May 1855, forwarding extract from Mr. Henwood's Report on the subject of preserving our forests from destruction.

2. Mr. Henwood's observations on this head appear to refer to all forests; he does not confine his remarks to those requisite to mining operations, but expresses a fear, that under the system of devastation now pursued, wood will soon be a scarce article.

3. In most parts of the District where cultivation bears a small proportion to the waste land, the greater inroads made on the forest the better, because extensive undisturbed jungle harbours so many deer, bears and tigers, that the animals soon become more powerful than the villagers, and the destruction of life and crops becomes so great that the village is abandoned, the waste land before long becomes a forest, and its wild animals make their attacks on another village. The only

way of keeping down the destructive denizens of the forest is to cut down patches at different places, by establishing cow-sheds and making temporary settlements; the villagers keep up communication between these and gain sufficient confidence to shoot or hunt the deer and destroy the beasts of prey as opportunity offers. If the practice of making clearings in the forests were prohibited, and the villagers were prevented using fire to get rid of the under-growth, the result would be increase of forest and decrease of cultivation, and I cannot think this would be a desirable change, seeing that such protected forests would be worse than useless and a curse to its surrounding villages.

4. As regards the supply of fuel in those localities where mines have been worked, or are likely to be opened, the only way of putting an end to the evil complained of by Mr. Henwood is to exclude forest lands, which it may be thought necessary to protect, from the boundaries of the villages which, by the conditions of the last and previous settlements, consider that they are entitled to use as grazing ground and for fire-wood. After such tracts had been marked off and declared to be Government property, they might be protected from fire, and the exclusion of cattle from such waste lands would in most cases be no great hardship, because sufficient land might be left within the boundary of each village for its cattle. If any individuals had large herds of buffaloes or cows, which would be a very rare case, they could be removed to more extensive pasture lands, where the forests were not protected. It is a long time since I have visited the Khetsaree mines and the country between these and Semul Khet, but as far as I remember, there are no established villages near the jungles, and I would suggest, that where any do exist, the forests allotted to each be apportioned according to the assessed area, and all clearings in excess of the recognized allotment be strictly prohibited, that no fires be allowed and no cattle be permitted to graze within the Government preserve at any time of the year. If the miners cut fuel judiciously, the forest in the vicinity of Semul Khet and Khetsaree would furnish a permanent supply of fuel. If a Company took a lease of the mines, the forest attached to them ought to be under the management and protection of the said Company, but if, as hitherto, the mines were worked by a native lessee, it would be hopeless to expect the charcoal-burners to observe any organized system.

What I have said regarding Semul Khet and Khetsaree jungle is applicable to all parts of the District where iron or copper mines exist, as I

am not aware of any that are not surrounded by or within a short distance of extensive forests.

If you approve of my suggestions, measures for carrying out the proposed system may be adopted without delay, but if details applicable to each mining District are considered necessary, I must delay submitting a full Report until I have had the opportunity of visiting them.

I have the honor to be, &c.,

(Signed) H. RAMSAY,
Senior Assistant Commissioner.

No. 3 in No. 1718 A. of 1855.

NOTE regarding FORESTS and FUEL in KUMAON and GURHWAL.

1. The opinions which Mr. Henwood expresses in his Reports, regarding the destruction of the forests of Kumaon and Gurhwal, have frequently been heard before, and have frequently been discussed in this Province, always I believe with the same results in the judgment of those who, from their knowledge of the country, are the best qualified to form an opinion.

2. An ordinary traveller through these hills sees little of the forests. The roads which are most frequented lie generally between 3,000 and 6,000 feet above the sea, an elevation at which comparatively little forest exists. The only tree which is abundant at that height is *Pinus Longifolia,* and even this is seldom seen in perfection in those parts of the Province which are the most frequently visited.

3. The part of Kumaon which is the best known to European travellers is naturally more deficient in timber than perhaps any part of the Province. Between the Gagur and the Bhutkot and Binsur ranges there is a belt of comparatively treeless country. Exactly the same thing holds good in Gurhwal.

4. There are no grounds for supposing that the mountains in this part of the Province were ever covered with forest, and that the present deficiency of timber has been brought about by the destructiveness of the inhabitants. There is no better reason for supposing that the Almorah hill was once covered with forest than that forests once existed in the Doab of Hindostan: both suppositions are mere theories.

5. The principal mines of Kumaon, that is, those which have hitherto been considered the principal, are situated in this comparatively woodless District—I say *comparatively*, for even here the actual quantity of wood is often considerable, but there is certainly no mine within 10 or 15 miles of which immense forests do not exist, and the most important mines are very much closer than this to supplies of fuel, which, for all practical purposes, I confidently declare to be inexhaustible.

6. The chief points to which attention has lately been called are the proposed iron mines near Kaleedoongee in the Bhabur, and the mines of the Khetsaree valley near the Gurhwal frontier.

7. With regard to the Bhabur iron, Mr. Henwood speaks as if it were doubtful whether sufficient fuel exist even for a small blast furnace. Such an opinion is to me quite inexplicable. Mr. Henwood totally ignores the existence, not only of the great forests which cover the hills from their foot up to the summit of the Gagur range more than 8,000 feet above the sea, but of the forest which everywhere lies at the base of the Himalaya, where the mountains rise from the plains. This great forest is one of the best known and most remarkable features of Upper India. I may safely say that this forest is confessedly one of the most extensive in the world. These forests, moreover, being for the most part in a flat country are easy of access. Many hundred square miles of unbroken and untouched forest are available for mining operations in the Kumaon Bhabur. The Dechowree mines are actually in this forest. Of their mineralogical value I know nothing—I speak only of the fuel. The saul forests may remain untouched. They constitute a very small part of the great forest tract, and leaving them out of the question, a supply of timber will remain for smelting purposes, the extent of which is *enormous*. I cannot conceive how there can be any difference of opinion on this point among people who have seen the Bhabur forests, and Mr. Henwood's statement is, I repeat, to me, inexplicable. I believe that there is enough fuel within an easily accessible distance of Dechowree to supply the largest mining establishment for a hundred years to come.

8. It is not to be wondered at, that a casual observer should consider that there was a deficiency of timber in the vicinity of the Khetsaree iron mines. Within a few miles of the mines, undoubtedly, there is not much timber, and I doubt whether there ever was any very great quantity; but Mr. Henwood was evidently unaware of the existence of the extensive and untouched forests of oak and pine which cover the sides

of the Doodatolee, Doorga Dee, Byansee, Budhangurh, Bhutkot, and Doonagiree ranges, within five to twelve miles from the mines.

9. I believe that the time is still distant at which mining operations on an extensive scale can be carried on in the vicinity of Khetsaree with any prospect of success, and I think it premature accordingly to enter into speculations on the subject. The distance from the plains and the total want of practicable roads are obstacles which nothing but an immense expenditure of money will overcome. When the time arrives (and I do not doubt that it will arrive some day) for the iron mines of Khetsaree to be worked on an extensive scale, I feel very confident that the want of fuel will not be one of the difficulties.

10. The fact I believe to be, that the want of fuel now complained of is entirely the result of the pettiness of the operations that are carried on. The demand for fuel is so insignificant, that the immediate vicinity of the mines can alone be brought under contribution, and the supply remains as insignificant as the demand. If large establishments were to spring up, there would be no want of fuel.

11. A good illustration of my meaning presents itself. In the whole of Kumaon there is perhaps no place so far removed from the forests as Almorah. The greater part of the fuel required for the town and cantonments of Almorah, containing perhaps 8,000 people, comes from a distance of seven or eight miles, and even more; yet there is probably no place in the District where wood is brought and sold, where fuel is cheaper. Wood has always been cheaper at Almorah than at Nynee Tal, although the latter place is surrounded on all sides by thick forests. At the present moment I am informed that fire-wood sells in the Nynee Tal bazar at eight or nine loads* per Rupee, and at Almorah at ten to eleven loads. Almorah is certainly more distant from the forests than any of the mines with which I am acquainted, and the same thing which happens at Almorah will happen at Khetsaree or elsewhere when the demand arises.

12. The proper way of looking at the question is to consider that Kumaon and Gurhwal are covered, as a general rule, with forest. *The absence of forest is the exception.*

13. The apprehensions that have been expressed, that the forests are being rapidly destroyed, are altogether visionary. The forests are so extensive, that I quite agree with Captain Ramsay, who says that the "greater

* A load may average 20 seers.

the inroads made upon them the better." At present, through a large part of the Province, a permanent contest is going on between the wild animals of the forests and the human inhabitants, and in this contest the latter are by no means uniformly victorious. I think any measures would be very unfortunate in their results, which should lead the people to suppose that the Government viewed with disfavour the reclaiming of the jungles.

14. No measures of precaution are in my opinion necessary. A multitude of young trees is springing up in every forest of importance, and vegetation is so rapid in this climate that no measures for the renewal of the forests would be necessary, even though the process of destruction were going on more rapidly than I suppose to be the case. The fires, which are complained of by Mr. Heenwood, improve I believe, rather than injure, the growth of the trees. Little is consumed except grass and decayed wood, and whatever effect the fires may have in thinning the forests is, I believe, beneficial to their growth.

15. Nothing that I have now said applies to the saul forests of the outer hills, the strict preservation of which is a matter of high importance.

16. The Deodar timber, which exists very sparingly in this Province, ought also in some cases to be rigidly protected. The Deodar woods, near Pakee Tungnee in Gurhwal, are one example, and when I was in that District, strict orders were issued by me for the preservation of the Deodar timber : unfortunately no great quantity remains. The forest near Somesur, in Kumaon, probably also deserves protection. Deodar timber, when found in easily accessible sites is so valuable, and in this Province it is so scarce, that measures for its preservation ought not to be neglected. I think a little money would be well spent in forming some experimental Deodar plantations. Last year I distributed large quantities of the seed in Gurhwal, but without much hope of any useful results.

(Signed) J. STRACHEY.

Nynee Tal, 31*st July* 1855.

No. 4 in No. 1718 A. of 1855.

No. 102 of 1855.

From

W. C. WATSON, Esquire,
Senior Assistant Commissioner, Gurhwal,

To

J. H. BATTEN, Esquire,
Commissioner of Kumaon.

Dated Camp Lobha, the 23rd July 1855.

Sir,

I have the honor to acknowledge the receipt of your letter No. 167, dated 3rd May, with its annexures as noted in the margin, calling upon me to report on the best means for preserving the forests of this District, more especially those in the neighbourhood of the Semul Khet iron mine, with reference to future mining and smelting operations.

Secretary to the Government of the North-Western Provinces, letter No. 891, dated 28th April 1855.
Extract paras. 12 to 14 of Report of Mr. W. J. Henwood, dated 1st November 1855.

2. In reply, I have the honor to submit, that it appears to me that Mr. Henwood was mistaken in supposing that the conflagrations so common in these hills are destructive to the growth of timber. The grass on every hill-side is either accidentally or deliberately set fire to once or twice every year. The flame, fierce and rapid, goes on its course, but it does not materially injure the trees amongst which it passes—even the young and tender seedlings are seldom destroyed by a mere conflagration of under-grass. It will be perfectly easy to put a stop to the deliberate burning of this jungle-grass, but no superintendence, however numerous and extensive, could prevent its accidental ignition, for, at certain seasons, it is almost as inflammable as gunpowder.

3. Undoubtedly much may be done in putting a stop to the wasteful cutting of timber for fuel, and this without unfair interference in the prescriptive right of the inhabitants to cut in the immediate neighbourhood of their villages; one simple rule is necessary, *viz.*, that every individual felling a tree must remove the whole, both timber and branches: where wood is left on the ground and becomes dry, it is of course ignited by the first casual conflagration of jungle grass, and if it happens to lie in any quantity, it burns with such duration and intensity as to commu-

nicate with all the growing trees to leeward. For the same reason all trees which die or fall spontaneously in forests which it is desirable to preserve should at once be cut up and removed.

5. I am not disposed to recommend the maintenance of nurseries and the planting-out of young trees. With the present inexhaustible supplies of timber, supplies which are constantly renewing themselves, I see no necessity for so expensive an undertaking. It must be remembered, too, that it is charcoal, not timber, which is required for smelting operations, and it is comparatively of little importance whether this description of fuel is brought from the neighbourhood or from a greater distance. If the demand is steady and continuous, I have no doubt that charcoal will be brought as readily from distances of 8, 10 or 12 miles as from the more immediate neighbourhood. The ordinary mountain foot-paths are quite sufficient for this species of traffic.

6. To repeat in conclusion, I would simply recommend that general orders should be issued to prevent the wilful burning of forests or underwood, and to insist upon the removal of every portion of those trees felled for fuel or other purposes in the neighbourhood of villages.

I have the honor to be, &c.,

(Signed) W. C. WATSON,
Senior Assistant Commissioner.

No. 1917 A. of 1855.

From

W. MUIR, Esquire,
Secy. to the Govt. of the North-Western Provinces,

To

CECIL BEADON, Esquire,
Secy. to the Govt. of India, Home Department,
Fort William.

Dated Head Quarters, Nynee Tal,
The 22nd September 1855.

Public Works.

Sir,

With reference to your letter No. 887, of the 13th July last, I am directed to forward, for submission to the Hon'ble the President in Council, the copies

1. Lieut.-Colonel Drummond's Report, dated 15th August 1855, *with original enclosures.*
2. Letter from Mr. Barratt, Assistant Mineral Surveyor, dated 15th August 1855.

3. *Memorandum by Mr. Sowerby, Civil Engineer*, East India Railway, dated 31st August 1855.
4. Letter to Commissioner of Kumaon, dated 7th September 1855, No. 1797 A.
5. Ditto to Chief Engineer, East India Railway, North-Western Provinces, dated 7th September 1855, No. 1798 A.
6. Letters from Commissioner of Kumaon, dated 7th and 14th September 1855, Nos. 317 and 325, with enclosures.

of documents noted in the margin, on the subject of the direction of the iron smelting experiments in Kumaon, and to communicate the following observations on the part of the Lieutenant-Governor.

2. The discovery of a seemingly inexhaustible supply of workable iron ore, peculiarly well suited for yielding the kind of iron which is most useful for railway purposes, along the outer face of the lower Himalaya ranges close to the plains, is a fact of the greatest importance, and one the practical value of which calls for the earliest and closest examination.

3. The Hon'ble the President in Council will perceive from the letter addressed to the Chief Engineer of the Railway Company in these Provinces, on the 7th instant, that the Lieutenant-Governor intends to have a more detailed and prolonged examination into the extent and quality of the iron formation on the whole outer range of the Kumaon Hills, after the close of the rains, and no time will be lost in submitting the result of this enquiry for the information of the Supreme Government.

4. Meanwhile, in concurrence with the strong and unanimous opinion of all the local and other* best qualified Officers on the spot, the Lieutenant-Governor does not doubt that the experiments in iron smelting, to be instituted during the coming cold season, should be made, not at Burrulgaon, far in the interior of the mountain country of Kumaon, but at Dechowree, the most favorable of the two places visited by Mr. Sowerby, where iron ore (of the clay iron kind, better suited for smelting after the European practice than the purer ore of the interior mines,) together with fuel, lime-stone, fire-clay, and a ready command of water, is found to be in such great abundance. It is accordingly His Honor's intention to direct the construction of the smelting machinery at that point; the employment of Mr. Barratt, Mr. Gray, and Mr. Davies, during the winter months, being regulated in the manner suggested by the Commissioner of Kumaon, in his letter dated the 14th instant. It is possible that, after the smelting operations have been fairly commenced, the Commissioner may find further appropriate employment for the services

* See Mr. Barratt's Report to this effect among the enclosures.

of Mr. Gray in visiting some of the copper mines of the Province, as his future information may lead him to think desirable.

5. Captain Ramsay, the Senior Assistant, who has more personal knowledge of the climate of the outer ranges and the Bhabur tracts than any of the other of the local Officers, has no doubt that, by arranging for residences for the Europeans employed on elevated parts of the hills which rise immediately above Dechowree, or other points where working stations may be established, no serious risk to their health will arise from their undertaking the daily superintendence of the smelting operations. There will also, Captain Ramsay is of opinion, be no want of hill-labourers at such points throughout the year, as the hill-men have latterly settled permanently in cleared tracts within the Bhabur forests.

6. The resolution here reported will, of course, be subject to any instructions which the Hon'ble the President in Council may be pleased to communicate. The Lieutenant-Governor, however, is himself well satisfied that the course which he has proposed to follow is by far the most promising for the satisfactory prosecution of the contemplated experiments, and indeed, as far as he can judge, a marked degree of success, such as has hitherto been quite unexpected, may be looked for from directing the efforts of capitalists, who may be willing to embark in iron speculations in this country, to the easily accessible tract where the existence of rich iron ores in large quantities has now, for the first time, been fully disclosed.

7. In submitting this Report, I am directed to add that the Lieutenant-Governor will be on the watch to use every further opportunity which may offer itself of testing the value of the Bhabur iron ores, by the investigations of other competent parties; and he will be prepared, of course, to modify his present views and intentions if he should find any serious reason to doubt their correctness.

I have, &c.,

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

P. S.—Since the above letter was drafted, a reply has been received from the Chief Engineer, East India Railway, North-Western Provinces, granting to Mr. Sowerby the permission requested, to remain in Kumaon

for the time necessary to make a complete examination of the beds of iron ore in Kumaon.

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

No. 1 IN No. —— OF 1855.

REPORT ON THE IRON OF THE PROVINCE OF KUMAON AND GURHWAL, BY LIEUTENANT-COLONEL H. DRUMMOND, 3RD REGIMENT BENGAL CAVALRY,—*Fellow of the Geological Society of London and Wernerian Society of Edinburgh.*

THE Hon'ble the Court of Directors of the East India Company having been pleased to recommend to the Government of India my employment in this Province, with the view of carrying on the investigations necessary to satisfy the public in England that sufficient inducement existed for the investment of capital in iron-works, I entered on that duty on the 18th October last, and the following are the results of these investigations.

Remarks on existing mines.

2. The existence of iron mines in the interior of the Province has been long well known, and I have on previous occasions called attention to them; but the transport of a heavy material like iron being a most important matter of consideration, my first inquiries were directed to the discovery of iron ore as near the plains as possible, in order to obviate the necessity of carriage through a mountainous country, which would greatly increase the cost of the iron; and I am happy to be able to report that my investigations in this respect have been most completely successful.

Description of iron ore localities near the plains.

3. The first locality which I visited was Doolmar, about 7 miles East of Nynee Tal, near the summit of the ridge on the right bank of the Bulleea stream. The ore found here is a granular brown iron ore in a sand-stone formation. On breaking the ground, the deposit however did not appear extensive, but there were evidences of former smeltings by the natives.

Kotah.

4. The next place I visited was the Kotah District, at the foot of the hills, about 12 miles West of Kaleedoongee. Here some little smelting appears to have been carried on formerly, judging from slag I found in the fields, along with

detached specimens of brown iron ore in some of the ravines, and indications of a deposit at Palkote in a primary clay slate formation; but on trying the ground I was unsuccessful here likewise in discovering a bed of ore.

Bhabur Iron Ore Deposits.

5. The specimens obtained at Doolmar and Kotah I directed my people to show to the villagers and cow-herds who were in the habit of penetrating the forests of the lower hills, requesting that they would bring me any stones they might find of a similar sort.

6. Very shortly afterwards I had a specimen of iron ore brought me from a place called Loha Bhurbhur, situated about two miles West of Kaleedoongee. I immediately proceeded to the spot, and discovered enormous masses of brown clay iron ore exposed at the surface, the hill where it existed being apparently almost entirely formed of it. In order to ascertain the extent of the deposit, I opened the ground in several places, and one cutting, which was made to a depth of 36 feet and 50 in length, passed through ore nearly the whole distance, which maintained an appearance of good quality.

Bhabur deposits, Loha Bhurbhur.

7. Continuing my researches along the foot of the hills, I traced this deposit to about a mile-and-a-half of Kaleedoongee, exposed in similar masses at the surface.

8. During the progress of the excavations at Loha Bhurbhur, I ascertained that there was iron ore at a place called Dechowree, about 7 miles West of Kaleedoongee. The ore here is a rich red clay iron ore, similar in character to that of Loha Bhurbhur, and likewise occurring in large masses exposed at the surface. The excavations which were made here, together with the quantity of ore exposed, proved the great extent of the deposit.

Dechowree.

9. Beyond Kaleedoongee Eastward about six miles, and near Chowsilla, I found a thin out-crop of ore of the argillaceous kind.

Chowsilla.

10. Proceeding Eastward towards Huldwanee, at a place called Beejapore, I found another deposit of clay iron ore. This was not easily discovered at first, owing to its being covered with surface soil and very little exposed. The out-crop was about a foot thick. I made considerable excavations at this

Beejapore.

place, one of which was an open working, to a depth of 31 feet, entirely through iron ore. At the bottom of this cutting a drift or horizontal gallery was driven 61 feet into the hill and passed through iron ore the whole distance: the thickness of the bed appeared to be very little under 50 feet.

Jham.

11. At Jham, 7 miles to the East of Huldwanee, I found the iron ore again similar to that at Beejapore, but of a more compact character and more exposed. Here also I made several excavations, the results of which showed the bed to be about 25 feet in thickness.

Bhurgote.

12. At Bhurgote, East of Jowlasal, on the road to Burmdeo, I found the ore again occurring and exposed in large masses similar to the deposits of Loha Bhurbhur. A drift was cut here 28 feet in length. This and the quantity exposed at the surface showed the bed to be of very considerable thickness.

Shikarkola and Dhandoongra.

13. At Shikarkola and Dhandoongra, still further to the East, I found immense beds of red and brown clay iron ore, exposed in masses lying on the surface, similar to those already mentioned.

Burragur.

14. At Burragur, about 5 miles from Birmdeo (the point of boundary with Nepal,) the clay iron ore again appears in enormous masses. My researches at the foot of the hills terminated here.

Remarks on deposits at foot of the hills.

15. The whole of these deposits from Dechowree to Burragur (a distance of nearly 60 miles) are found imbedded in the great sand-stone formation, of which the outer hills are chiefly composed. I have subsequently learnt that ore is found exposed to the Westward of Dechowree. This I have not had an opportunity of visiting, but I believe it to be highly probable that the deposits will be found in that direction as far as the sand-stone formation continues. The beds above described, however, amply show that an inexhaustible supply of iron-stone can be obtained at the foot of the hills, from which iron can be manufactured for an unlimited period. Analyses and assays of these ores will be found in the Appendix.

Byala, within the hills.

16. I will now notice two other localities in the sand-stone formation, a little within the hills, where clay-iron ore is to be found. The first is Byala, a village about 5 miles from Kalounea at the foot of the hills. There is a bed of red clay

iron ore at this place, often of a very rich and compact character. I here made several excavations, and the bed appeared to be about 15 feet in thickness. There were traces of former smeltings here by the natives.

Durragur, within the hills.

17. The next deposit is at Durragur, about 5 miles West of Byala, where I found the bed to be 22 feet in thickness, It is a poor clay-iron ore imbedded in sand-stone, and is seen crossing a small stream in nearly perpendicular strata. This is the last of the clay-iron ores I have already discovered, situated within what is termed the Bhabur.

Facilities for working the Bhabur Iron.

Local facilities for working in the Bhabur.

18. Having described the deposits of iron ore in the Bhabur I shall now point out the local facilities for the establishment of works.

Fuel.

19. Charcoal fuel can be obtained in any quantity from the extensive forests that cover the whole country, spreading to a breadth of about 10 miles into the plains, and backwards up the hill-sides for many miles into the interior. Forests of such vast extent and density are sufficient to guarantee an unlimited supply of fuel, which, by a judicious system of cutting, so as to allow of their renewal, would last for ages. Mr. Jameson, the Superintendent of Botanical Gardens at the North-Western Provinces, informs me that much of the timber is hard wood, which makes the best charcoal. A letter from this gentleman on this subject is given in the Appendix.* A partial clearing of the Bhabur forests will be productive of the most beneficial effects as regards the climate of the District.

Clay.

20. Fire-clay accompanies the beds of ore, and is found exposed in many places. A trial of that at Dechowree was made by Mr. Davies, the smelter, which proved it to be suitable for smelting operations.

Lime-stone.

21. Lime-stone can also be obtained at Dechowree, and is available within a tangible distance of the whole of the Bhabur deposits.

Sand-stone.

22. Sand-stone from Dechowree was tested and found to be well adapted for furnace work.

Loam and sand.

23. Loam and sand also occur suitable for moulding.

* Vide Appendix No. 1.

24. Water power, at all seasons of the year, can be obtained from many of the streams issuing out of the mountains into the plains, which can easily be confined or diverted for the purpose of driving machinery.

Water power.

25. The transport of the produce from the works to the great markets of consumption, or places of shipment on the navigable rivers, can be easily accomplished, the mines being situated so near the level of the plains and always accessible to wheel carriages: cheap tram-ways could be readily laid down as soon as the works are in active operation.

Transport.

26. Judging from the great abundance of raw materials for the manufacture of iron on the Bhabur, the local facilities existing there, and the numerous advantages presented by its proximity to the markets and freedom from hill carriage, it would appear desirable to establish works in that District in the first instance.

Proposal to establish works.

27. It is therefore proposed to commence working by the erection of a furnace at Dechowree. The necessary outlay for starting a work on a small scale will be about Rupees 5,000 (see estimate by Mr. Davies in the Appendix. This would consist of a small blast furnace, with a water-wheel and other apparatus, and be sufficient to prove the practicability of manufacturing iron on the spot. It would also form the nucleus for extending the works hereafter. Mr. Davies has estimated the cost of producing a ton of pig-iron by this apparatus at Rupees 46 and the additional cost of making castings about Rupees 25. This however would be gradually reduced as the works progressed. (The estimate is given in the Appendix.) The ore found at this spot is easily smelted, and particularly well adapted for the manufacture of grey pig-iron, the description used for foundry purposes: it is superior in richness to the clay-iron ore of the coal formations of Great Britain, from which most of the iron is produced, and the average of which seldom exceeds 30 per cent., whereas that of the Dechowree ores is upwards of 40 per cent. (*vide* analyses and assays in Appendix.) The capability of making heavy castings on the spot will enable the iron-works to be extended without the necessity of importing them from England. The clay-iron ore of this District is also well suited for the manufacture of railway bars and every other description of heavy iron work.

Experimental works on a small scale.

Water power.

28. The River Boer will supply sufficient water power for the blowing of the furnace.

Roads.

29. There is at present a good road for nearly the whole distance from Dechowree to Mooradabad, which is about 50 miles, at which point the Ramgunga is navigable a great part of the year. The cost of conveyance from Kaleedoongee to Moradabad, about the same distance, by carts, at present, is about Rupees 6 or 12 shillings per ton.

Climate of Dechowree.

30. The situation of Dechowree a little above the plains will, when cleared of jungle, be perfectly healthy at all times of the year. The exact spot where the works are proposed to be erected is already partially cleared, and the hill-men who cultivate the ground live there the whole year round. The residences for European head workmen can be built on the hill-sides immediately above the works, which here rise rapidly to a very considerable elevation.

Opinion of Captain H. Ramsay, Senior Assistant Commissioner, Kumaon.

31. The great objection which has been apprehended to the possibility of establishing works in the Bhabur, has been the alleged unhealthiness of the climate during the rains. This is proved, however, to be greatly exaggerated, if not altogether without foundation. Many villages in the Bhabur are permanently occupied throughout the year by cultivators, who have originally immigrated from the hills. Captain H. Ramsay's (Senior Assistant Commissioner of Kumaon) letter, which will be found in the Appendix,* is conclusive evidence on this point, as he has had great experience.

Opinion of Mr. Sowerby, Engineer, East India Railway.

32. I feel perfect confidence in selecting Dechowree as the place where iron works ought to be commenced and extended hereafter, from the facts already stated; and I am fully borne out in this opinion by that of others of practical experience. Mr. Sowerby, one of the Engineers attached to the East India Railway, kindly visited the locality at my request, and expressed a highly favorable opinion regarding the quality of the ores, the extent of the deposits, and the facilities for establishing works. Mr. Sowerby has inspected most of the iron districts in England, was practically engaged in iron works in Durham, and lately was deputed

* Appendix No. 2.

to examine the mineral resources of South Africa. *He is therefore a most competent authority on the subject.* A letter from this gentleman will be found in the Appendix.*

33. Mr. Davies, the smelter, who recently came out from England, and has been engaged all his life in such works, states that he never saw so much iron ore before, and bears the strongest testimony to its quality. A letter from Mr. Davies will be found in the Appendix.†

Mr. Davies the smelter's opinion.

34. It may be a matter of surprise to some, that the native miners and smelters allowed such valuable deposits to remain unnoticed, and that the fact of their occurrence was quite unknown to them, no traces of former workings having been found from Dechowree to Burragur, but this is explained by their rude process being ill adapted for the smelting of such ores. I had however trials made of them by that process, using lime-stone as a flux, with which the natives were unacquainted, and succeeded in obtaining bars of iron.‡

Mines of the Bhabur not worked by natives.

Search for rich ores near the plains.

35. With the view of ascertaining whether the more compact and richer ores belonging to the primary rocks existed within a less distance of the plains than these already worked, I directed my researches to this subject, and found them in two localities, but in no great quantity.

Search for rich ores near the Bhabur.

36. The first of these is at Sath Tal, near Bheem Tal, about 7 miles from the plains, where I discovered a thin out-crop of red iron ore, but on breaking the ground it appeared to be a deposit of small extent.

Sath Tal.

37. The next locality is Amdong, near Malwa Tal, also about 7 miles from the plains. Here there is an out-crop of red iron ore seen on the right bank of the Gola stream: I drove a gallery into it 33 feet in length, but the deposit did not improve, thinning off to a seam of 2 inches. On the opposite bank of the river I found some favorable indications of specular iron ore, so that it is possible a workable deposit may exist there, but consider-

Amdong.

* Appendix No. 3. † Appendix No. 4.

‡ Analyses of the ores by Dr. Macnamara, Chemical Examiner to Government, and Mr. Piddington, along with Assays by Mr. Davies, will be found in the Appendix.

able expenditure will be necessary to prove this, owing to the rock in which it is imbedded being quartzose and difficult to mine.

Iron mines worked by the natives in the Hills.

Ramgurh, &c.

38. The iron mines nearest to the plains, that are worked by the natives, are those of Agur or Ramgurh and Dhunia Kote, which are between 15 and 20 miles from the foot of the hills. These embrace a large tract of country, about 20 miles in length. The ores to be obtained are the rich micaceous, specular, magnetic, red hematite, and brown iron ores. These mines have long been well known and were extensively worked in the time of the Kutyoor Rajahs, and are occasionally worked at the present day. Many old workings are apparent, particularly at Nutwakan, where the natives now procure the ore by cutting away the props or pillars of the old workings, which are of solid ore. The precise thickness of the beds I have been unable to ascertain, but there can be no doubt that they are very considerable: the reason they are not more extensively worked is not from the want of the iron, but the want of skill and capital. The mountain range in which the principal mines are situated is called "Loha Kote" or iron mountain, and the iron district includes the Dhunia Kote mines to the West and Purburra to the East of Loha Kote.

Mungla Lekh.

39. In a line with Phurburra, and about 20 miles to the East, are the Mungla Lekh mines, in the Dhyanee Row District the ores of which are magnetic and micaceous, and from these the best iron in Kumaon has been heretofore produced. They are only partially worked by the natives in the present day. This is the last of the series along the second parallel or section of country, within an average distance of 20 miles from the plains.

Facilities for working in Ramgurh fuel.

40. Fuel in great abundance can be obtained from the Gagur forests, on the Southern bank of the Ramgurh stream. These forests chiefly consist of oaks and other hard woods, as well as pines, extending with little interruption to the great Bhabur forests at the foot of the hills.

Stone for furnaces.

41. Stone (quartsoze) found in this District has been tried by Mr. Davies, the smelter, and proved to be fit for furnace work, being highly refractory.

Lime-stone.

42. Lime-stone is abundant.

Sand.

43. Sand for moulding can also be obtained.

Water power.

44. The Ramgurh stream will supply sufficient water power for propelling machinery.

45. The transport of the produce of these mines will be by means of bullocks, mules, &c.; the metal will have to be carried in the shape of pigs to the foot of the hills to be re-manufactured. Tram-ways may be ultimately introduced as the works progress. These could be carried along the sides of the Gagur range, and over the Shamkhet, or one of the other passes, by a succession of self-acting inclined planes, or the streams may be used where practicable for raising the material. Beyond the passes there is a continued descent to the plains. The practicability, however, of such a mode of transport will require to be thoroughly investigated by a competent Engineer.

Transport.

46. The last Districts where iron ore has been found in abundance, and which are at present worked, are Khetsaree to the Westward and Chowgurkha to the Eastward, in the interior of the Province, and above 50 miles from the plains. The ores found in these Districts are principally red iron ore and red hematite at Khetsaree, and brown ore and micaceous iron ore at Chowgurkha.

Khetsaree and Chowgurkha mines.

47. The mines at Khetsaree were partially worked formerly, and within the last forty years have been more extensively worked. The beds of ore are of considerable thickness, and it is from these mines that the greater part of the iron now manufactured in the Province is obtained, owing to the abundance and cheapness of provisions in the Ramgunga Valley.

Khetsaree.

48. Fuel can be procured in a limited quantity at Khetsaree; the forests, which are pine, having been much thinned by the native miners, but large supplies might be brought down from the extensive forests further up the Ramgunga Valley.

Local facilities. Khetsaree fuel.

49. Fire-clay and refractory stone is found near the mines.

Fire-clay.

50. Lime-stone is also at hand.

Lime-stone.

51. Water power can be obtained in any quantity that may be required from the Ramgunga River.

Water power.

52. The transport of the produce of this District to the foot of the hills will have to be by bullocks, mules, &c., but the distance of about 50 miles from the plains will materially increase the cost of the iron. The cost of a good road will, it is understood, be upwards of Rupees 200,000 (£20,000,) and this expendi-

Transport.

ture would not be advisable when so much ore is found in more accessible situations.

53. There are other localities in Gurhwal where iron ore is worked, but these I have not yet had an opportunity of investigating.

Gurhwal.

CONCLUDING REMARKS.

In taking a general view of the whole of the iron deposits above described, they may be divided into three separate parallel lines—*first*, the beds of ore in the line of the Bhabur; *second*, those of Ramgurh and Mungla Lekh; *third*, those of Khetsaree and Chowgurkha. They all appear to follow the same general course or direction, parallel to the line of greatest elevation, and the general dip is a little to the East of North. Between these great deposits, there are a few smaller beds of ore and other highly ferruginous deposits, forming a succession of connecting steps between each parallel. Such a vast and inexhaustible supply of iron ore is, I believe, unsurpassed anywhere. But the existence of iron ore of ever so rich a quality or abundant in quantity, is of itself unimportant, unless it be accompanied with other favorable circumstances. Advantages of the nature referred to are to be met here, and the fact of iron ore being found over such an extent of country renders the choice of a site for the establishing of works a matter of easier accomplishment than it otherwise would be. The great local advantages possessed by the Dechowree deposits, which have been already specified, point them out as peculiarly suited for the commencement of operations.

One consideration yet remains to be noticed, namely, the command of cheap labour. This has been found a serious obstacle in other countries where iron ore obounds, as in Australia, the Cape of Good Hope, and parts of America. Here, on the other hand, we have native miners and smelters, the latter being well acquainted with iron and the first rude modes of making it; they also display considerable dexterity when working, and readily comprehend anything that may be suggested to them. Of ordinary labour we have an unlimited supply. The rates of pay are as follows:—

Common labourers and coolies,............		per day,	2	annas.
Miners and Smelters, ...	from	„	3 to 5	„
Carpenters, ...	„	„	3 to 5	„
Masons, ...	„	„	3 to 5	„
Charcoal-burners, ...		„	2	„

There would require, however, to be introduced into the country properly qualified head-workmen from Europe, for superintending the different departments of labour. The selection of these superintendents is a matter of the most vital importance, as on them in a great measure depends the success of the undertaking. Every precaution will therefore be necessary to secure good men.

With regard to any improvements that can be suggested on the present manufacture, very little good can be done. By this method no less than 11 cwt. of the richest description of ore, and 11 cwt. of charcoal, are used to produce 1 cwt. of iron, whereas, in properly regulated works, the same quantity of ore, with 6 cwt. of charcoal, should yield 6 cwt. of metal. It is evident therefore that nothing can be more wasteful and expensive then the present system. The cheapest description of iron work that can be erected is the Catalan. This, if adopted, would be an improvement, but still be very inferior to the common high furnace. The Catalan method is similar to the native, but it is also wasteful in fuel and only adapted for malleable iron.

In conclusion, it may be remarked that the establishment of works of this description will doubtless be accompanied with some few obstacles. By ordinary caution, however, combined with energy and perseverance, results I believe may be ultimately obtained which in value and importance will not be exceeded by similar works in any other part of the world. The daily increasing demand for iron in India, especially for railway purposes, and the inability to meet such demand by existing means, highly favors the introduction of an improved system of manufacture at the present period ; I would therefore urge the immediate commencement of the proposed trial works at Dechowree.

(Signed) H. DRUMMOND,

Lieutenant-Colonel.

Nynee Tal,
The 15*th August* 1855.

(True Copy)

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

POSTSCRIPT.

SOME misapprehension having arisen regarding the character of the ores recently discovered by me in the great sand-stone formation at the foot of the Kumaon hills, I may mention that I have, for the sake of clearness, termed them Red and Brown clay iron ores. This term will not be found in any mineralogical work, but I preferred giving it, that the distinction may be at once drawn between them and the Red iron ores and Red hematites and Brown iron ores and Brown hematites of the older rocks, which, with the other varieties, such as the Specular Magnetic, &c. are of the purest description, and contain the largest amount of metal. It is from these that the superior iron of Sweden and Russia is produced, and in our own country an iron of great tenacity, and much used for drawing into wire, is obtained from the Red hematite ore of Cumberland with charcoal smelting. Steel also is made from it for secondary purposes.

The Red and Brown iron ores of the Bhabur, however, are of a different description—they are associated with clay, and hence may be correctly termed clay iron ores. It must be remembered, however, that although clay iron ores, they are nevertheless distinct again from our clay iron ores in England. The former are the Red and Brown oxides of iron in combination with clay, and the latter, carbonates of iron associated with clay. A small portion of carbonic acid is frequently contained in the former, but that does not affect the distinction I have drawn. The percentage of iron contained in these ores ranges (it will be observed from the analyses in Appendix) at from 20 to 66 per cent. of metal, and when the deposits come to be tried thoroughly, their average will probably be found to exceed that of the clay iron-stones of England about one-fourth. When I made this discovery last cold season, I then expressed the opinion I had of the great importance of this description of ore for the following reasons.

The iron immediately required in this country for rails, heavy castings, &c., is not so much the finer description to be obtained in such vast quantities from the ores in the older rocks of the Himalaya, Gwalior, Bundlekund, and various other Districts throughout India ; but what is wanted is the coarser and stronger iron from clay iron ores, like those of the Bhabur and the clay iron-stones of the coal formations, the extent of which in this country we have not the least conception of at present. The finer

description of iron above alluded to, though admirably adapted for many purposes, is not so well suited for rails, &c., as that produced from clay iron ore, being of a softer character, the result of its comparative purity. Nothing imparts strength to iron more than its combination with clay, but clay, when used singly with rich ores, is apt to clog the operation of the furnace. When intimately combined with an ore, however, part of the iron in the ore fluxes the clay and the work progresses favorably.

Hence it is that the iron best suited for rails is the English iron, from its superior hardness, strength and adaptation to wear; and to obtain the same description in this country, we must look to the clay iron ores.

I have entered into these particulars, as I have said, to prevent misapprehension with regard to the nature of the newly-discovered ores. My Report, as a whole, is intended to be merely a general outline of my explorations and discoveries, embracing as they did a great extent of country. But the period for these having been limited to about seven months, more specific details will require a considerably longer period and closer examination than has as yet been allowed me for the purpose.

There is another point I should wish to advert to. In 1852, when in England, I circulated a pamphlet "On the importance of establishing Iron Works in Northern India." In that I suggested, that a small rolling mill should be sent out to Kumaon for the purpose of fabricating the native bloom metal into bars.

Although, however, the improvements suggested were perfectly safe, and the very best mode of commencing with the knowledge then before the public, the recent discovery of clay iron ore at the foot of the hills renders it more advantageous to commence at once with foundry iron. Mr. Davies, the smelter, fully agrees with me with regard to the plan referred to being a good one, and an expeditious and practical method of bringing Kumaon iron at once into the market in a proper shape; but the clay iron ore being so favorably situated and much better adapted for castings than the ores of the interior, we shall now in consequence of the discovery be able to make our own rough castings for the machinery, only getting at the first start the rolls, the screws, and the nuts for the rolls from England.

ADDITIONAL ANALYSES OF BHABUR CLAY-IRON ORES.

Received from Dr. Macnamara, Chemical Examiner to Government.

Dechowree Mine.

		In 100 *grs.*	
Best Quality	No. 1, Selected Specimen, ...	66·3	Metallic Iron.
	„ 2, Ordinary, ...	55·6	

Eastern Bhabur Ores.

	Iron per cent.
No. 1, Bhurgote, ...	50·1
„ 2, Shikarkola, ...	62·4
„ 3, Dhandoongra, ...	41·6
„ 4, Burragar, ...	42·8
„ 5, Ditto, ...	53·3
„ 6, Ditto, ...	48·8
„ 7, Byala, ...	54·6
„ 8, Ditto, ...	52·1

H. DRUMMOND,
Lieut.-Colonel.

Calcutta,
The 19*th December* 1855.

APPENDIX.

No. I.

To

COLONEL H. DRUMMOND.

MY DEAR DRUMMOND,

IN reply to your question, "Are hard woods fitted for making charcoal plentiful in the Bhabur and lower hills of Kumaon ?" I may state that they abound, and in confirmation of what I assert, mention a few of the more common timber trees :—

Saul—Shorea (Vatica) robusta.
Sein—Pentahtera tomentosa.
Sissoo—Dalborgia sissoo.
Kikur—Acacia Arabica.
Koher Kikur—Vachilla Jarnessiara.
Khyr—Acacia catechu.
Sandur—Dalborgia organansis.
Lorius—Acacia Loisa.
Loisee—Acacia alata.
Adhwaree—Lagorstrœmia haviflora.
Koomtar—Gonelina arborea.
Bukhair—Melia sempervisens.
Neem—Azadviachta vulgaris.
Jand—Prosobis specigira.
&c. &c. &c.

This list could be greatly extended, but the few specimens above mentioned will be ample to corrobarate what I have asserted.

Yours, &c.,

(Signed) WM. JAMESON.

Hawulbaugh,
Kumaon, 10*th August* 1855.

No. II.

No. 26.

To

LIEUT.-COLONEL DRUMMOND,

On special Duty in Kumaon.

SIR,

I HAVE the honor to acknowledge the receipt of your letter of yesterday's date, in which you request me to state whether a mining company would experience any difficulty in procuring workmen at Dechowree, and if the climate at the foot of the hills is too unhealthy for the residence of Europeans.

2. In reply to your first query, I have no hesitation in stating that any number of coolies, masons, carpenters, or blacksmiths could be procured at Dechowree throughout the year, at the rates of pay usually given during the cold weather, *i. e.*, coolies at Rupees 4 per mensem, and artificers, according to their skill, from Rupees 6 to 10 per mensem. This fact, which I have proved by the experience of five years, shows that natives have no fear of the climate. I have at this moment about 150 workmen (almost all hill-men) in the vicinity of Kaleedoongee working on canals and roads.

3. As soon as the dense forest at Dechowree has been cleared, that place no doubt will be more healthy than Anta, where Europeans could live without any risk of fever. Probably Europeans would erect their dwelling-houses on the spars running up from the flat, where you made some excavations last cold weather. On these heights the nights would be pleasantly cool, the heat during the day would be bearable, and a

residence in such a climate would be far preferable to the most favorite stations of the plains.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) H. RAMSAY,

Asst. Commr., Kumaon.

Nynee Tal,
The 20th July 1855.

No. III.

To

LIEUT.-COLONEL DRUMMOND,

Nynee Tal.

Almorah, 31st July 1855.

MY DEAR SIR,

I WILLINGLY reply to your inquiries about the iron ore found at Dechowree, &c.

When I was first shown a piece of this ore some time ago, I believe I estimated the percentage at about 49 or 50, and I particularly noticed its kindly character for smelting, owing to its being associated with clay. From its high percentage, it will have to be mixed in the furnaces with ore of an inferior richness, to prevent its running too freely; it will then produce the best grey metal pigs fit for foundry purposes. It will also prove an excellent ore from which to manufacture railway bars, and such like heavy iron, as well as the finer kinds.

The presence of clay in the ore will tend to make the iron produced from it hard and durable; richer iron ores yield a softer iron, which is not calculated for standing wear and tear well.

On my visiting the Bhabur with you, where the ore is obtained, I noticed that the beds were very large, in fact forming entire hills, and therefore there need be no apprehension of the beds being readily exhausted. Ores of this description are usually found in large beds, and I was not at all surprised at seeing such an enormous quantity of ore lying exposed. I have seen them of a similar description at the Cape, quite as extensive, but an English iron master would look upon such an

enormous quantity as something very extraordinary, for he is certainly not accustomed to see anything equal to it at home.

The manufacture of cast-iron rails for temporary purposes on the lines now in course of construction would be very desirable, and this I think could be very readily accomplished. A few European smelters would be wanted in the outset, but no heavy machinery, nor any extensive or costly works beyond the ordinary blast furnaces.

Trusting the above remarks may be found satisfactory and useful,

I remain, yours very truly, &c.,

(Signed) WM. SOWERBY,

Civil Engineer.

No. IV.

To

COLONEL DRUMMOND.

Almorah, August 10th, 1855.

SIR,

I BEG leave to inform you, in answer to what you want to know from me about Dechowree, the mine is very good, and it is the best for all purposes; it will make good foundry pigs of which to make casting for erecting forges and rolling mills for the manufacture of railway bars and other marketable iron; for this it requires several hundred tons of castings, which could be made on the spot.

There is good water power and plenty of lime-stone, and a large quantity of iron-stone to be seen in the hill-side at Dechowree and Loha Bhurbhur, which would astonish the Welch iron masters if they saw it. I measured in one place 275 yards long, 107 yards wide, 4 yards in average thickness, but the exact thickness is not known—this would give 117,700 cubic yards, taking the average of the common clay iron stone in South Wales. Three cubic yards will make one ton of pig iron—this will give 39,233 tons. There is good moulding sand in the neighbourhood and plenty of wood for charcoal. It is, in my opinion, the best and most advantageous place I have seen in all our round in Northern India.

I am, Sir,

Your obedient Servant,

(Signed) REES DAVIES,

Smelter.

No. V.

Analyses by Dr. Macnamara, Chemical Examiner to Government.

Name of Place.		Per-centage of Iron.	Remarks.
Dechowree, ... Ordinary Varieties.	Red Clay Iron Ore, ...	46·9 (in grs.)	The remainder of the analysis have not yet come to hand.
	Ditto,...	47·7	
	Ditto, ...	49·2	
	Ditto,...	55·47	
	Ditto, ...	49·7	
Loha Bhurbhur, best quality, ...	Brown Clay Iron Ore,...	48·53	
Agur District, ... Nutwakan Mine, ...	Micaceous,...	70·72	

(Signed) H. DRUMMOND,
Lieutenant.-Colonel.

No. VI.

Lieut.-Colonel Drummond's Kumaon Ores.

No. and Names.	Water, &c. Carbonic Acid	Earthy Matter	Arsenic.	Carbonic Lime.	Iron Peroxide.	Less or Excess.	Contents Metallic Iron.	Remarks by Mr. Piddington.
No. 1 (Dechowree),	1·56	19·10	5·70	0·50	68·65	— 4·49*	47·60	* Some arsenic driven off with sulphur.
,, 2 (Dechowree),	2·00	22·40	0·91	2·60	73·50	+ 1·41	50·96	
,, 3 (Loha Bhurbhur, ..	2·50	20·00	7·91	1·90	75·05	× 7·36†	52·00	† Excess from peroxidation of theprotixde., &c., specular iron.
,, 4 (Loha Bhurbhur,) ..	W. 2·75 C.A. 5 00	43·75	3·90	2·43	42·02	— 0·15	29·13	
The Slag, ..	....	40·25	3·65	....	60·13	× 4·03‡	46·42	‡ Excess from peroxidation.
No. 5 (Turwagur).	W. 5·40 C.A. 4·35	44·40	...	12·00	27·60	— 6·15§	19·14	§ Loss from water of combination with earthy matters and iron.

(Signed) H. PIDDINGTON,
Curator, Museum Economic Geology.

The 23rd August 1855.

No. VII.

Specimens of Iron Ore accompanying the Report.

No. 1	Dechowree,	...	Red clay iron ore.
„ 2	Ditto,	...	Ditto ditto.
„ 3	Ditto,	...	Ditto ditto, calcined.
„ 4	Ditto,	...	Ditto ditto.
„ 5	Loha Bhurbhur,	...	Brown clay iron ore.
„ 6	Ditto,	...	Hydrated ditto.
„ 7	Ditto,	...	Ditto ditto, calcined.
„ 8	Bejapore,	...	Friable red clay iron ore.
„ 9	Ditto,	...	Ditto ditto.
„ 10	Jham,	...	Brown clay iron ore.
„ 11	Bhurgote,	...	Ditto and red ditto.
„ 12	Shikarkola,	...	Red clay iron ore.
„ 13	Dhandoongra,	...	Brown ditto.
„ 14	Burragur,	...	Ditto ditto.
„ 15	Byala,	...	Compact red clay iron ore.
„ 16	Doolmar,	...	Brown sandy ore.
„ 17	Amdong,	...	Red oxide.
„ 18	Khyrna,	...	Red hematite.
„ 19	Tutyte,	...	Ditto ditto.
„ 20	Ditto,	...	Magnetic.
„ 21	Ajowlee,	...	Compact red iron ore.
„ 22	Loorkinnee,	...	Scaly red iron ore.
„ 23	Nutwakan,	...	Micaceous specular.
„ 24	Pali,	...	Ditto ditto.
„ 25	Loorkianee,	...	Siliceous red iron ore.
„ 26	Nutwakan,	...	Ferruginous slate.
„ 27	Gulla,	...	Magnetic iron ore.
„ 28	Dhoora,	...	Micaceous specular.
„ 29	Jagur,	...	Inferior black oxide.
„ 30	Bunnah,	...	Brown iron ore.
„ 31	Beeroo,	...	Micaceous specular.
„ 32	Dhoora,	...	Siliceous black oxide.
„ 33	Rooie,	..	Magnetic.
„ 34	Parburra,	...	Brown iron ore.
„ 35	Mungla Lekh,	...	Magnetic.
„ 36	Chowghurka,	...	Micaceous specular.
„ 37	Ditto,	...	Brown iron ore.
„ 38	Khetsaree,	...	Red iron ore.
„ 39	Ditto,	...	Ferruginous slate.
„ 40	Kalabund,	...	Red oxide.

(Signed) H. DRUMMOND,
Lieutenant-Colonel.

N. B.—18 Specimens of Iron accompany the above.

No. VIII.

Estimate for a small Blowing Machine by Mr. Davies.

					Rs.	As.	P.
9	Maunds of Iron, at Rs. 20 per maund, ...				180	0	0
	Excavation for Water-wheel, ...				50	0	0
	Masonry Work at Water-wheel, 1,820 cubic feet, at Rs. 16 per 100 feet, ...				291	3	2
12	Pieces of Timber for the framing, Rs. 20 each, ...				240	0	0
12	Ditto of ditto for upright ditto, Rs. 10 each, ...				120	0	0
3	Ditto ditto Saul-wood for Water-wheel, at Rs. 20 each, ...				60	0	0
64	Arms and Boards for Water-wheel, at Rs. 2 each,				128	0	0
108	Feet of Boards for the Water-wheel, 12 inches wide × 1½ inch thick, ...				40	0	0
24	Pieces for Cylinder, at Rs. 3 each, ...				72	0	0
16	Ditto for framing, at Rs. 2 each, ...				32	0	0
80	Feet of Boards for Water-wheel, 12 inches wide × 1½ inch thick, ...				29	10	0
216	Ditto ditto for the Blast, 14 inches wide × 1½ inch thick,...				80	0	0
80	Ditto ditto for Water-wheel, ...				29	10	0
	One maund of Screws and Nails, ...				20	0	0
	One ditto of Brass for the Bearings, ...				30	0	0
40	Carpenters, for 3 months, at Rs. 6 each per month, ...				720	0	0
40	Coolies, for 3 months, at Rs. 5 each per month,...				600	0	0
	Masonry Work at Furnace, 7,160 cubic feet, at Rs. 16 per 100 cubic feet,...	1145	9	7			
30	Coolies, for 3 months, at Rs. 5 each per month, ...	450	0	0			
	Excavation at Furnace, ...	40	0	0			
					1635	9	7
	Diverting and Embanking Stream, say, ...				50	0	0
	Total, ...				4408	0	9
	Add 10 per Cent. Contingencies, ...				440	0	0
	Grand Total, Rupees, ...				4848	0	9

(Signed) H. DRUMMOND,
Lieutenant-Colonel.

No. IX.

Estimate of the cost of making Pig Iron at Dechowree by Mr. R. Davies, Smelter.

	Rs.	As.	P.
4 Europeans, at Rs. 50 each per week, ...	200	0	0
30 Natives at Furnace, Rs. 1-8 each ditto, ...	45	0	0
4 Tons of Charcoal per day, at 2 annas per maund,	98	0	0
6 Ditto of Iron Ore ditto, at 1 anna ditto, including clearing, breaking, and carrying, ...	73	8	0
1¼ Ton of Lime-stone per day, at 2 annas per maund,	30	10	0
Total, per week, ...	447	2	0

One Furnace will make 14 tons per week, or 364 tons in six months, and the first year, supposing the works to stand for six months, and the Europeans are paid for doing nothing, the ton of iron will cost about	46	0	0
The second year, by getting two Furnaces to work, and only working six months in the year, the iron will cost	32	0	0
By keeping two Furnaces regularly at work throughout the year, and including wear and tear, the iron will cost ...	25	0	0
In five or six years, when natives are able to work the Furnaces, and by getting four or five Furnaces to work, the iron I think will be made for	15	0	0
The cost of making common castings from the Pig Iron, including moulding, re-melting, &c., will be about	25	0	0

(Signed) REES DAVIES.

No. X.

Trial Assays by Mr. Davies, the Smelter, with his Remarks.

No. of Trials.	District.	Names of Mines.	Percentage.	Remarks by Mr. Davies.
1	Bhabur Iron Ores.	Dechowree, ...	49½	Good grey cinder, very easy to smelt.
2		Ditto, ...	37½	Ditto.
3		Loha Bhurbhur, ...	40	Ditto.
4		Ditto, ...	47	Ditto.
5		Ditto, ...	48	Ditto.
6		Ditto, ...	28	Ditto.
7		Ditto, ...	20	Ditto.
8		Bejapore, ...	35	Ditto.
9		Jham, ...	37	Ditto.
10		Bhurgote, ...	35	Ditto.
11		Shikurkola, ...	39	Ditto.
12		Dhandoongra, ...	39½	Ditto.
13		Burragur,	33	Grey cinder, with small dust of iron on the surface.
14		Ditto, ...	30	Ditto.
15		Ditto,	24	Ditto.
16		Byala, ...	54	Ditto.
17		Ditto, ...	53	Ditto.
18	Agur.	Micaceous Iron Ore, ...	63	Light grey cinder. Iron, very easy to smelt
19		Magnetic ditto, ...	72	Difficult to smelt.
20	Khetsaree.	Red Iron Ore, ...	52	Ditto.
21		Ditto, ...	72	Ditto.
22		Ditto, ...	50	Ditto.
23		Slaty ditto, ...	40	Easy to smelt.
24	......	Purburra Brown Iron Ore,...	58	Grey cinder, difficult to smelt.
25	......	Doolmar Brown Sandy Ore,	25	Ditto.

(Signed) REES DAVIES.

No. 2 in No. — of 1855.

(Copy.)

J. H. BATTEN, Esquire,

Commissioner,

&c., &c., &c.,

Almorah.

Hawalbaugh, 11*th August* 1855.

Sir,

In continuation of my letter of the 9th instant, respecting the iron deposits of Kumaon, it occurred to me, after reading some remarks on iron for railways in the *Lahore Chronicle* of the 28th ultimo, that with capital and perseverance a sufficient supply of iron can be obtained from the mineral resources of India, independent of importation from any other country. I cannot conceive why there should be such scarcity or lack of railway iron, when the road is being laid through a country which probably has the greatest iron deposits in the world, and nothing wanting but spirit and capital to develope the mineral resources which would supply the railway demand. If one-hundredth part the amount paid and intended to be expended in railway iron was employed in bringing the great and inexhaustible deposits of rich iron ore of this and other Provinces in rail bars, there would not be the anticipated delay in the Delhi and other lines at the present moment. It is not too late now to begin (better late than never)—what is not gone to market still remains to be sold. In this Province I have seen an iron formation whose breadth ranges from 30 to 70 feet of smelting—one of about 36 per cent. iron. I traced it for nearly 30 miles through a thickly wooded country, where the want of fuel cannot be felt for generations to come, and is quite accessible, being at the foot of the Himalaya mountains. Why can't this be smelted into bars and employed in the Indian railway? If carriage has anything to do with the delaying or retarding its being put into operation, why not lay down a railway, commencing at Kaleedoongee, which is in the heart of the Bhabur mines, and continue it to some of the rivers where the bars could be taken down in boats, or continue it to Mooradabad and thence to Meerut and Delhi, or where it may be most required. It will serve not only to take away iron but all other mountain commodities, and bring merchandize and passengers to the foot of the hills. There are also iron mines East of Jham,

which are known to be still richer than those already mentioned; there is every probability of still finding more rich deposits North-west of Dechowree to the Lerolla River along the foot of the hills; and where fuel is plentiful could be profitably worked. When the season becomes very hot in the Bhabur, and the mines of Kaleedoongee cannot be kept longer in operation, Ramgurh, which is two days' journey from it, is the place where smelting operations can be carried on through the year, and the Kaleedoongee force could be employed there until the weather permit of their return to the Bhabur again. The Ramgurh mines are very rich in micaceous iron ore, and any quantity can be obtained which will yield 50 per cent. iron, and fuel will be found plentiful. The site for the machinery to carry on smelting operations should be near the suspension bridge, where water power sufficient can be obtained and ore abundant on the spot. It will be seen, if smelting operations can be commenced and carried on at the foot of the hills, that roads will be very soon made to connect the nearer hill mines with those of the Bhabur. A spirited Company should have all the mines at the foot of the hills, and also those of the interior, so that if they require different kinds of ore for fluxing, they can obtain them. When smelting is established in these localities, and the carriage become cheap, the great iron mining district of Gunnai and Simulkhet will be turned to profitable account also; a branch of railroad could be brought up the Ramgunga Valley; then I should think the Bhabur, Ramgurh and Gunnai would contribute greatly towards the demands of the railways. A great many smelting establishments may be erected along the foot of the hills, which would turn out a great quantity of iron every year and relieve the wants of the railway contractors. If smelting is put in actual operation with the facilities here offered, there would be no need to halt or wait arrivals of iron from England or Wales, for I am quite certain the Province of Kumaon can guarantee a very noble part of the iron required in railways through India. In order to make a good beginning to develope these mineral resources, care should be taken to fix the commencing trial in the right spot, so as to insure success, and to stimulate capitalists to enter this worthy mining field. If a trial should be made in the interior mines, and the result good, how can the produce be profitably conveyed to market? What good will iron be if easily and economically extracted from the ores of the interior mines, when it has to be taken seven days' journey on men's backs to the plains? The beginning of this valuable undertaking should

be like house-building, at the *foot* or *bottom* first, and when a good foundation is laid, nothing can hurt the fabric.

I have, &c.,

(Signed) JAMES BARRATT,
Assistant Mineral Surveyor.

(True Copy.)

(Signed) W. MUIR,
Secy. to the Govt. of the North-Western Provinces.

NOS. 3. TO 6 IN NO. —— OF 1855.

(COPIES.)

OBSERVATIONS ON THE DEPOSITS OF IRON ORE IN THE LOWER HILLS OF BHABUR, AT LOHA BHURBHUR AND DECHOWREE, MADE ON THE 28TH AND 29TH OF AUGUST 1855.

LOHA BHURBHUR.

THE first indications of the existence of iron ore in this locality are huge blocks of it lying exposed on the surface of the hill-side, which here slopes at an angle of about 28° towards the plains on the South: there are no intervening hills between this and the plains, and the River Boer flows at the foot of the hill at the distance of about one mile.

The apparent direction in which these blocks of ore are found is on a line about one point South of West or North of East.

The ore is of a description called brown iron ore associated with clay (not mere clay impregnated with iron, but solid iron-stone.) Where it has been much exposed, as at the Western end, the ore is a good deal hydrated, and is of a light brown color with streaks of darker brown.

Commencing at the Western extremity, about 200 or 300 yards beyond the new road which cuts through the formation obliquely, the huge blocks are scattered all around for a width of about 100 yards measured down the slope of the hill. The stones at the extreme West end are of a slightly sandy and micaceous character: this however soon disappears.

After crossing the road (on each side of which huge blocks are seen,) it continues in an oblique direction down the hill-side for a distance of about a mile. Keeping lower down the hill, as shown in Section No. 1, the ore also increases in richness of quality and the width of surface,

over which the blocks extends to about 250 yards. I measured several of these large blocks, which were upwards of 10 feet long, 6 feet broad, and 4 feet in thickness, and which, if smelted into pig-iron, would each yield upwards of three tons of metal—these blocks were not occasional, but frequent and common over the whole distance traversed.

In order to ascertain the approximate quantity of ore lying upon the surface, I measured and counted the number of blocks within a given space: this I did at several places and took an average, which was about 16 cubic feet per square yard.

Assuming this as the basis of calculation,—and 1,760 yards in length by 175 yards in average width, will give 182,518 cubic yards of ore on the surface,—taking the average percentage the same as English ironstone of a similar kind, 3 cubic yards to the ton, there is 60,839 tons of metal which would be obtained from the ore at the surface. This calculation I believe to be within the full quantity, and the average percentage will I think be found to be much higher than the English ironstones.

The whole of this may be taken as in stock, requiring neither mining nor quarrying, but merely breaking up and calcining, to be ready for the furnaces.

These blocks of iron ore found on the surface do not appear to have travelled any distance, being sharp at their edges, whereas the sand-stones found along with them are rounded by attrition: this indicates that the bed from whence the blocks of ore came cannot be far distant, and several excavations have been made in order to ascertain this point.

The side of the hill where the blocks of ore are visible are traversed by small ravines or water-courses usually dry, except during heavy rainfalls. Advantage has been most judiciously taken to open the ground in these ravines, where the surface soil has been partially removed by denudation, enabling the bed of ore *in situ* to be readily reached without any great extent of excavation.

The first opening has been made at a little distance beyond the new road to the Eastward, the bed of ore *in situ* and undisturbed is here clearly exposed by the excavation made to a depth of 15 feet, and apparently going deeper as the floor of the bed had not been reached at that depth, it is a clear and distinctly defined compact bed of hydrated brown iron ore, being of a lightish colour, with dark streaks. The direction of the strike of the bed is about 2 points South of West or

North of East, inclining to the East at an angle of 20° and dipping into the hill at an angle of about 30°. There are several cracks or fissures in the bed which are filled with clay; these cracks do not exceed one-quarter or half an inch in thickness, and the clay found in them is highly impregnated with iron. Section No. 2 is the section of the strata at this point.

About 100 yards further to the Eastward and about 40 feet lower down, there is another cutting, whereby the bed is again exposed to a thickness of 15 feet: 9 feet of the bed here is very solid and compact; the remaining 6 feet at the lower part of the bed is laminated or shaly, (*See* Section No. 3.)

About 200 yards further on to the Eastward, and at about the same level as the last cutting, a shaft has been sunk 35 feet deep, passing the whole distance through iron ore. The bed appears from the number of cracks or fissures to have been very slightly disturbed at this point, and its uniformity partly destroyed. The ore is a rich brown hydratad iron ore, occasionally having a slight metallic appearance when fractured, and the cracks and fissures are filled with clay very highly impregnated with iron.

The next excavation is in a ravine now having a small flow of water through it—this excavation exposes a very rich brown iron; 6 feet of it is very solid and compact, quite heavy in the hand and rather metallic in appearance when fractured, and contains probably 45 or 50 per cent. of metallic iron. The lower part of the bed is hydratad brown ore, as in the former cuttings; this cutting had partly fallen in, but Section No. 4 will be found I think pretty nearly correct. The bed here is apparently undisturbed, but about 100 yards lower down the ravine is a large mass of compact brown iron ore several yards in length, which appears to be a large portion of the bed that has slidden down the hill in an unbroken state.

Beyond the last point to the Eastward is another ravine, where the bed is again partly exposed by denudation, and a few slight cuttings have been made, but not sufficient to form a section from.

The bed appears to be continuous throughout the whole of this distance, which is nearly or quite a mile, but to what distance beyond at either end, it is impossible to say. It is also impossible to tell how far the bed may go underneath the hills, it may however but very reasonably be expected to go a very considerable distance. The bed appears,

to have originally extended considerably further Southward towards the plains, and some disturbing cause has broken up the outer edge of it, the broken portions of the bed appearing in huge blocks at the surface as already described; the superficial soil having been washed away has left the huge blocks of iron ore remaining quite exposed, and projecting out at the surface as already described.

The bed is least rich in the upper or Western end of it, and becomes richer towards the lower part: this is exactly as it should be, and it is very probable that the bed will become richer in quality throughout its entire length further into the hill: this is however not at all desirable, as it is quite rich enough for practical purposes already.

The character of the rock in which the ore is embedded is a micaceous sand-stone.

The position of the locality is about 500 feet above the plains.

Dechowree.

Rich, extensive and valuable as the deposits of Loha Bhurbhur undoubtedly are, those at Dechowree are still more so.

The bed or beds here are very readily discoverable, not only by the large masses on the surface, as at Loha Bhurbhur, but also by the beds being so very extensively exposed *in situ* by deep ravines made by the denudation of the beds and surface soil.

The first point where the bed appears is close to Dechowree village, in and near the course of a small tributary of the River Boer. On the Northern side of the stream it is exposed to a thickness of 9 feet, dipping into the hill at an angle of 56°, one point to the West of North. It is visible in the bed of the stream, and again on the opposite bank. An approximate section is given in Section No. 5. The ore here is a rich red iron ore associated with clay; it is exceedingly compact and heavy in the hand, and of a metallic appearance when fractured, also spoked with small pesiform crystals, and contains about 50 per cent. of metallic iron. Large masses are lying about in the bed of the river and on its banks. One mass, a piece of which had been analysed by Mr. Piddington and found to contain 50 per cent. of iron, would yield, if smelted, upwards of one ton and a half of pig-iron.

Beyond the village to the Westward on the the hill-side, which slopes down towards the River Boer, about 200 feet below the village, and a short distance from it, large, compact and solid masses are found all

about on the surface, especially in a ravine which is usually dry and which traverses the hill in an oblique direction. About half way down the hill the ravine cuts through the solid bed of ore *in situ*, and is thereby exposed to a thickness of 30 feet and upwards. The bed appears quite undisturbed and unbroken, excepting a few cracks or fissures, which are very thin and filled with highly ferruginous clay or earthy matter. From this ravine, in a Westerly direction, the bed is continuously exposed to various depths or thickness; in one place the earth has been cut away and the bed measured 24 feet, but the floor had not been reached at that depth; the strike of the strata is nearly East and West, inclining at an angle of 27° to the West, and dipping into the hill at an angle of 40°. (*See* Section No. 6.) The ore is here also a rich red clay iron ore, occasionally brownish, but invariably heavy and massive or compact, and the fracture generally slightly metallic in appearance. Other cuttings have been made further to the Westward; there is a broad open ravine, with a bold high scar or precipitous cliff, where the the bed of ore is exposed naturally by denudation to a height or thickness of 50 feet and upwards; at the foot of this scar several excavations have been made, in order, if possible, to reach the floor of the deposit; but this has not been arrived at; the bed appears quite undisturbed and *in situ*. Where a bed of such rich material is ascertained to be at least 50 feet thick, a few feet more or less cannot be a matter of much importance.

The broad open space at the foot of this ravine is filled with gravel of iron ore, and there are two isolated pillars of solid iron-stone left standing out and rising to a height of about 30 feet. No. 7 is a section at this point.

Beyond this ravine Westward the huge blocks of ore are again seen on the surface at the hill-side, but quite hidden by the over-grown dense forest and under-wood—to what extent and distance more might still be discovered is unknown, sufficient however is to be seen without much trouble which shows in the most unmistakeable manner that the deposits are something stupendous, so much so that it would be almost impossible to exaggerate them for surpassing the limits of ordinary calculation, and beyond anything that will be required for supplying works even of an unusual extent.

The quantity of ore at and near the surface over the whole extent of ground traversed, namely, one mile, would yield, if smelted, upwards of

100,000 tons of pig-iron, if taken at a low estimate both as to quantity and percentage.

Side by side with the iron ore are large quantities of most excellent lime-stone lying about in broken fragments of a large size, and in the broad ravine mentioned there is a bed of excellent fire-clay. The ore is of a very kindly qualtity and character for reduction, and appears to contain a portion of lime, which is favorable.

The local facilities at Dechowree are very great—there is a considerable stream (the Boer) which passes within 100 yards of the beds of ore, sufficient to supply water power for all requisite purposes, and the timber of the surrounding dense forests of almost boundless extent will amply supply fuel, and it is of a size and quality peculiarly suitable for making charcoal.

The position of Dechowree appears to be between 200 and 300 feet above the level of the plains, and the climate appears by no means unhealthy, especially in the open parts cultivated near the village. The hills are quite adjacent, and rise very high close to. The partial clearing of the forests would doubtless greatly improve the climate by freeing it from the rank vegetation, and the neighbourhood of large iron works are usually particularly free from epidemic diseases.

These two localities are not the only spots where iron-stones of a good quality may be found within no great distance from the plains, as there are many favorable indications to be seen in other places, but with the extensive deposits of Loha Bhurbhur and Dechowree, the necessity for looking for other beds may be safely regarded as a very remote contingency.

(Signed) W. SOWERBY,
Civil Engineer.

Nynee Tal,
The 31*st August* 1855.

No. 1797 A. of 1855.

From

WILLIAM MUIR, Esquire,
Secy. to the Govt. of the North-Western Provinces,

To

J. H. BATTEN, Esquire,
Commissioner of Kumaon.

Dated Head Quarters, Nynee Tal,
The 7th September 1855.

Public Works.

Sir,

I am desired to forward copy of a Memorandum by Mr. Sowerby, Civil Engineer, on the deposits of iron ore at Loha Bhurbhur and Dechowree, and to state that its tenor is so highly encouraging, that the Lieutenant-Governor has officially requested the Chief Engineer of the Railway Company for these Provinces to permit Mr. Sowerby to remain until the 15th November in Kumaon, for the purpose of supplying a full Report, after the most minute and continued inquiry that can be necessary, both on the Dechowree and Bhurbhur iron beds, or the other beds of the same metal, that may be found along the whole face of the outer hills accessible throughout the Bhabur from the Rohilcund Districts.

2. Opinion also seems to be unanimous among Officers resident in Kumaon, that it is at the foot of the hills, and especially at Dechowree, that the intended experiments on the smelting of iron may most advantageously be conducted, and the strong considerations in favor of such a site over one in the interior of the Province are too obvious to require comment.

3. The Lieutenant-Governor will therefore be prepared, subject to the orders of the Supreme Government, to transfer the place of the experiments which has been sanctioned by that authority to Dechowree, if your view should be decidedly in favor of that course. An early Report is requested from you on the subject.

I have the honor to be, &c.,

(Signed) W. MUIR,
Secy. to the Govt. of the North-Western Provinces.

Head Quarters, Nynee Tal,
The 7th September 1855.

No. 1798 A. of 1855.

From

WILLIAM MUIR, Esquire,

Secy. to the Govt. of the North-Western Provinces,

To

E. PURSER, Esquire,

Chief Engineer, East Indian Railway, N. W. P.

Dated Head Quarters, Nynee Tal,
The 7th September 1855.

Public Works.

Sir,

Copy of Mr. Sowerby's Memo., with sketches in original, to be returned with reply.
Copy of Colonel Drummond's demi-official letter, dated 20th August 1855.
Copy of letter to Commissioner of Kumaon, No. 1797 A., of this date.

I am directed by the Hon'ble the Lieutenant-Governor to forward the papers noted in the margin, on the subject of the deposits of iron ore at Loha Bhurbhur and Dechowree, and to request your sanction to the continuance of Mr. Sowerby in Kumaon till November 15th, for the object stated in para. 1 of the letter to the Commissioner.

2. The fullest examination of the Bhabur iron ores is considered by the Lieutenant-Governor to be, under present circumstances, an object of the greatest public importance. Mr. Sowerby is understood to be a gentleman well qualified for the duty, and a detailed statement of his independent opinion, and of the grounds of it, will carry with it useful authority for the general information of those interested in such enterprises.

I have the honor to be, &c.,

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

Head Quarters, Nynee Tal,
The 7th September 1855.

No. 217 of 1855.

From

J. H. BATTEN, Esquire,
Commissioner, Kumaon Division,

To

WILLIAM MUIR, Esquire,
Secy. to the Govt. of the North-Western Provinces.

Dated Almorah, 7th September 1855.

Public Works.

Sir,

With reference to your letter No. 1661 A., dated 3rd ultimo, and after attentive consideration of the orders of Supreme Government, on the subject of the iron working experiment in Kumaon, I have the honor to report as follows.

2. As instructed by the 4th para. of your letter, I have again held consultation in regard to the kind of blast to be used in the smelting furnace, and I have received from Mr. Barratt, Assistant Mineral Surveyor, his expressed opinion against the use of the *water-fall* blast recommended by Mr. Henwood. Having also obtained from your office the report of my Committee, formerly submitted, I have caused Mr. Barratt to annex thereto a separate Memo., embodying his own views in assent to those of the Committee. The record on this mooted point is therefore complete.

3. As I myself entertain no doubt whatever as to the inefficiency of the proposed water-fall blast, and as a cylinder blast to be worked by a water power, on the scale contemplated by Mr. Davies, the smelter, would be actually found cheaper of construction, besides being really efficient for the production of pig-iron at the furnace, I have had no hesitation in anticipating the orders of Government, and in taking steps for the preparation of all the necessary apparatus and machinery, both of wood and iron, at the vacant hospital building at Hawalbaugh, whence, when ready, the whole can be removed in pieces to Burralgaon, or elsewhere. The iron materials are now being forged by means of an English fan blast, under the direction of Mr. Davies. Part of the necessary frame wood-work is being prepared in a Deodar forest, half-way between Almorah and the Ramgunga Valley, and can be transported to the latter site at no great expense when required. The forest in question is also the nearest available for Deodar timber required in the lower pergunnahs.

4. With reference to the *site* of the proposed mining and smelting experiment, the opinion of the Supreme Government has been strongly expressed in favor of Mr. Henwood's selection. However, since the receipt of the orders under acknowledgment, His Honor the Lieutenant-Governor has, I believe, been convinced equally with myself and others, that Colonel Drummond's discovery at Dechowree and elsewhere, in the Upper Bhabur, of abundant ores of the best kind for *working purposes*, by the English method, is a real and most valuable *fact*. Under these circumstances, it becomes a most important consideration, whether or not to adhere to Mr. Henwood's selected site at Burralgaon. If the out-turn of iron for railway and other purposes is to supersede all other objects, there cannot be a doubt that the smelting operations should be commenced next November at Dechowree, but on the other hand, it must be recollected that the instructions originally issued to Mr. Henwood (copy of which is herewith enclosed) contemplate the *instruction* of the natives in all the smelting processes "at a locality perfectly open to their visits." In regard to this point there can be no doubt that the Khetsaree Valley is more favorably situated than the Kotah Bhabur. It should also not be forgotten, that at Khetsaree the iron ores are of that kind which are most abundant throughout the province, and in fact constitute the mineral wealth of the interior Districts. At Dechowree those who may resort to the mines for purposes of instruction would, unless I mistake, only learn the art of reducing the *clay* iron ores, unless indeed it should be found necessary to export to the Bhabur mines, from Ramgurh and Dhunniakote, a regular supply of the finer ores, containing at higher percentage of metal, for the purpose of mining them with the poorer sorts.

5. Whatever site may be selected by His Honor the Lieutenant-Governor for the operations, the same course of proceedings would be adopted between this time and the 1st of November; a healthy spot for the pitching of tents and the erection of well-thatched grass huts with stone walls, for protection of the party in bad or very hot weather, and as near to the proposed mine as possible, should be selected.

On the 1st of November Messrs. Barratt, Gray, Davies, and the interpreter, Mr. Thomas, should proceed to the site, carrying with them the machinery now under preparation, and by the 15th of November, I should hope, whether at Burralgaon or at Dechowree, to see the furnace built, the blast prepared, and everything ready for active work.

In the interval, Mr. Gray would commence his operations for digging out the ore by the English method, for which proper wheel-barrows are now being made. Mr. Barratt, after setting everything a-going, and establishing a proper system of account-keeping and payment of labor, should, I think, be deputed to carry on the mineral survey of the Province, more especially in regard to the deposits of lead, copper, &c., under the direct supervision of the Commissioner. It would be a waste of time to detain Mr. Barratt for the whole cold season either at Burralgaon or Dechowree.

6. My report on the preservation of the forests has already been furnished.

7. Proclamations offering rewards for the discovery of lead ore have been issued by me in Kumaon and Gurhwal, and I hope before two months shall elapse to be in a position to direct Mr. Barratt's investigations to the proper places; eventually, in case of our failing to discover lead mines in Kumaon, that gentleman may with advantage be deputed to the existing deposits at Khultsee and elsewhere on the Western borders of Dehra Doon.

I have the honor to be, &c.,

(Signed) J. H. BATTEN,

Commissioner.

Kumaon Commissioner's Office,
Almorah,
The 7th September 1855.

ENCLOSURES.

1. Letter of Mr. Barratt, Mineral Surveyor, dated 13th August 1855.
2. Report of Committee on smelting operations.
3. Copy of Mr. Secretary Beadon's letter to Mr. Henwood, dated 12th January 1855.

To

J. H. BATTEN, ESQUIRE,
Commissioner,
&c., &c., &c.
Almorah.

Hawalbaugh, 13*th August* 1855.

SIR,

IT is now clearly seen that Mr. Henwood and Mr. Gray laboured under false impressions regarding the water-fall blast they

saw employed in Brazil for smelting iron. Mr. Gray now declares that it was used to give blast to the Catalan furnaces, by which the iron is brought out in blooms and hammered like the blooms from the Hindoo furnaces in those hills. In that system of smelting it would not require half the blast required for the improved perpendicular furnace recommended to be used at Gunnaie, because the iron must be sufficiently melted so as to run out from the furnace into bars or pigs. The iron produced from the Brazilian works was never melted, which shows the water-fall is powerful enough to produce blast for that slow system of half smelting, and is far from being of sufficient power to give the required blast for smelting by which pig-iron is produced. Mr. Davies is not altogether wrong respecting the damp blast that must certainly be produced by the water-fall apparatus, because the air carries a portion of water with it which must tend to obstruct the melting of the ores. If the water blast proves damp and pressure is inadequate, which I conceive it must, our experiment must prove a total failure, and it is my candid opinion that it will prove so if trial is made with it. I have never seen it used for any other purpose than ventilating mines, consequently I could not nor did I ever have any part in recommending it.

I have, &c.,

(Signed) JAMES BARRATT,

Assistant Mineral Surveyor.

MEMORANDUM.

OUR opinion having been requested upon the best mode of giving effect to the orders of Government, "that a cheap blast furnace be erected at "Burralgaon for experimental smelting operations upon iron ore," we have carefully perused the documents transmitted to us, and have held protracted personal communications with Messrs. Barratt, Gray and Davies.

From the former (the documents) we learn that Mr. Henwood has directed the employment of a water blast for the smelting furnace, apparently under the impression that Mr. Davies proposed to conduct his operations upon a scale more suited to large and permanent than to experimental, and possibly temporary, operations, and that the water

blast could be applied most economically in the situation selected for the works.

This form of blast Mr. Henwood appears to have successfully applied in the Brazils.

The mode of obtaining the blast having been indicated by Mr. Henwood, our first attention was directed to the investigation of its details, with a view to ascertain the expense which its erection would involve at Burralgaon.

We are informed that the apparatus consists of a cylinder or rectangular box of wood, through which a vertical column of water is made to fall, and that the blast is obtained by the impetus imparted to the air which accompanies its descent. We also learn that the requisite velocity would not be obtained unless the fall and consequent perpendicular height of the vertical tube amounted to at least 60 feet.

The area of the section of the tube is required to be 324 inches, or a rectangle of 18 inches square. Without entering into any minute calculations, it is evident that, in order to maintain a constant supply of water, sufficient to furnish the discharge required, a very considerable stream must be divided artificially to some point, at least 60 feet above the bed of the valley, and we have ascertained that this could not be effected without leading the water along the face of a rock for a considerable distance and encountering other obstacles which could not be surmounted without a very considerable outlay.

But supposing this difficulty to be overcome, a serious doubt of the adequacy of the blast which would result has been suggested to us.

Mr. Davies, the smelter, to whom the reduction of the ore must of necessity be entrusted, informs us, that he has never seen the water blast applied to any other purpose than the ventilation of mines ; that smelting requires a blast capable of being forced into the furnace under a pressure of at least 2 lbs. to the square inch, and that he is apprehensive that the use of water in the production of the blast will have an injurious effect upon the quality of the iron, as it is well known that any moisture coming in contact with the ore in the furnace deteriorates the iron, and that it can hardly be supposed that air, which has been violently agitated in contact with water, should be otherwise than saturated with moisture.

Mr. Gray, who accompanied Mr. Henwood to the Brazils, informs us that the water blast which he saw in operation was not applied to a

smelting furnace for the reduction of ore, but to those in which the metal was worked after its separation from the ore—in fact, it was applied to what are commonly known as *forges*.

The erection of the water blast apparatus involves no difficulty; both Messrs. Barratt and Gray profess their ability to construct it, but both those gentlemen are unwilling to undertake to produce by it the pressure of air required for a smelting furnace.

It therefore appears to us a hazardous experiment to attempt the operation of smelting by means of an apparatus which would be very expensive, and at the same time very uncertain in its operation.

Such are the objections to the use of water blast, but Mr. Davies professes his readiness to undertake the operation of smelting, and to be responsible for the result, provided he be allowed to make use of the blast with which he is familiar and which is known to produce certain results.

He has shown to us the drawings of a cylinder blast apparatus prepared by himself, and showing all the working details, with which he is evidently well acquainted.

In this machine a water-wheel drives a crank, which gives a reciprocating motion to a beam, at each end of which a piston is attached, which works in a wooden cylinder or box, thus forcing the air, by alternate strokes, into a furnace, in the same way that water is propelled from a force pump.

With the exception of some parts of the driving machinery, the great bulk of the apparatus is of wood, and after a careful consideration of the estimated quantity of materials, as furnished by Mr. Davies, we feel some confidence in anticipating that the erection of the whole apparatus, including the furnace, and in obtaining the requisite head of water for the wheel, would not cost more than Rupees 5,000.

The result of the inquiries we have made may therefore be shortly stated to be—

First,—That a water blast at Burralgaon would be expensive, more so than that proposed by Mr. Davies.

Secondly,—That its application to smelting would possibly deteriorate the quality of the iron.

Thirdly,—That it is very doubtful whether the pressure required (2 lbs. to the square inch) could be obtained from the water blast. On the contrary, Messrs. Barratt and Gray incline to the opinion that although a

strong current of air would be produced, it would exert little force at the point of discharge into the furnace; and we are informed by Mr. Davies, that unless the air can at will be forced into the furnace, the aperture soon becomes clogged and the blast ceases to be efficacious.

Fourthly,—That none of the persons now in the employment of Government, in connexion with mining operations in Kumaon, have sufficient knowledge of or confidence in the water blast, to enable them to undertake the responsibility of its application to the smelting of iron ore.

Fifthly,—On the other hand, Mr. Davies is willing to undertake the responsibility of smelting if he is permitted to use the apparatus he is acquainted with, and Messrs. Barratt and Gray, not being themselves acquainted with the details of the process of smelting, but having full confidence in Mr. Davies's competence, are unwilling to interfere beyond their own province, and are anxious that the details of this operation should be left entirely in Mr. Davies's hands.

In this recommendation we fully concur, and we therefore strongly urge the adoption of Mr. Davies's mode of obtaining the blast, and with a view to the prevention of any unnecessary delay after the season for working commences, we would suggest that Mr. Davies be supplied with the necessary materials, and be directed to commence the construction of his cylinder and water-wheel during this season of inactivity, and that drawings of the iron work be sent to Roorkee for immediate preparation, so as to obviate any possibility of further disappointment by the loss of another working season.

(Signed) C. B. THORNHILL,
" H. RAMSAY, *Sub-Asst. Commy.*
" J. O'B. BECKETT, *Depy. Commy.*

ADDITIONAL REMARKS BY MR. JAMES BARRATT, ASSISTANT MINERAL SURVEYOR.

RESPECTING the blast apparatus recommended by Mr. W. J. Henwood for the iron smelting experiment at Burralgaon, I beg to say I concur with the views of the Committee, that is to say, it is not of sufficient power to produce the required pressure for smelting iron—it has been employed in extracting silver from copper and lead, which degree of heat is considerably under that required for smelting iron. The smelting furnaces seen by Messrs. Henwood and Gray in Brazil, where the

water-fall blast was in operation, were not of the improved perpendicular blast furnaces, but of the Catalan, which probably were not above 18 inches high, and all the iron they produced was brought out in blooms and hammered on the very same principle that is at present in operation with the natives in these hills. By this slow system of half smelting the ore is never melted, and for such purpose the water-fall blast will be found adequate, but not for the perpendicular high-pressure blast furnace of from 12 to 16 feet high. It has never been used in Brazil for smelting the ore into pigs or crude iron, or in any other place that I have seen or heard of, and it is my candid opinion that it is not fit for smelting purposes where pig-iron is required to be produced. Mr. Henwood evidently labored under false impressions regarding its use and qualification. I am fully persuaded, if it is employed at Burralgaon, from the defect of its force and the moisture of its blast, the experiment will certainly prove a failure.

(Signed) JAMES BARRATT,
Assistant Mineral Surveyor.

Hawalbaugh,
The 30*th August* 1855.

No. 325 OF 1855.

FROM

J. H. BATTEN, ESQUIRE,
Commissioner of Kumaon,

To

W. MUIR, ESQUIRE,
Secy. to the Govt. of the North-Western Provinces.

Dated Head Quarters, Kumaon,
The 14*th September* 1855.

SIR,

I HAVE the honor to acknowledge your letter, No. 1797 A., dated the 7th instant, enclosing Mr. Sowerby's Memorandum on the subject of the iron deposits at Loha Bhurbhur and Dechowree, at the Kotah Hills, and calling for my distinct opinion in regard to the proper site for the smelting experiment.

2. In my last communication on this subject, I recorded my views as to the carrying out of the instructions issued to Mr. Henwood, our late

Mineral Surveyor. The great and most important discoveries of iron within reach of easy carriage transport for the manufactured metal, now verified by Mr. Sowerby, have introduced new elements for the consideration of Government, and it becomes necessary I think to recur to the *original* objects of the *whole* scientific deputation to Kumaon, and to cease confining our attention to the particular instructions issued in India to its late conductor. In fact the out-turn of iron, with cheap abundance, and available for immediate uses in the plains, ought now, in my judgment, to supersede all other considerations.

3. Under this view I am now decidedly in favor of the first smelting experiment being made at Dechowree.

4. I would therefore recommend that authority be at once granted to me to make all preparations in regard to machinery, sites of furnace and miners' residences, &c. (alluded to in my last letter,) entirely with reference to Dechowree.

5. As mining skill will not be necessary at that site, or at Loha Bhurbhur, it becomes a matter for discussion what use to make of the services of Messrs. Barratt and Gray, especially the latter gentleman.

6. At first thought, it appeared to me that Mr. Gray might be usefully employed at Burralgaon and elsewhere in the Khetsaree iron district, in teaching the natives the English method of extracting the ore from the mines, and in superintending the charcoal-burners, watching the forest, &c. But on further reflection, I am of opinion that it would be at present premature to separate Mr. Gray from the main operations, because it would in that case be necessary to provide him with a special interpreter, as Mr. Thomas would of course remain with Mr. Davies, the smelter, because I very much doubt whether the native miners would voluntarily adopt the European system of mining galleries and barrows, &c., in a locality where iron ore is plentiful *at the surface* and labour of no account in their calculations, and because the teaching of the *miner's* art is only after all an incidental object, and one entirely subordinate to that of instructing the natives in the art of economical and productive smelting.

7. I would therefore propose to His Honor the Lieutenant-Governor, that in the first instance the whole European party should be deputed to the Dechowree works, due preparation for their reception at a healthy site having been previously made by Captain Ramsay and myself (who are proposing an early visit to Kotah for that purpose.) Mr. Barratt, as

head of the party, would remain with the others for a month, and would organize the whole system of labour and accounts, which he would then entrust to Mr. Gray, assisted by Mr. Thomas, the interpreter and apprentice. Mr. Barratt would then be deputed by the Commissioner to visit all the sites where lead has been discovered and to re-visit all the copper mines which have been too hastily and insufficiently examined during the flying tour of Mr. Henwood. He would thus be fully prepared to point out to the agents of any Mining Company which may be formed the different points to which their attention should be turned. His survey would not, of course, supersede that of his eminent chief and predecessor, but it would complete our information on *practical* points in regard to copper, while his whole ground in regard to *lead* would be new. Mr. Gray at Dechowree would superintend all the digging operations, and would land the iron ores at Mr. Davies's furnace, besides however general charge of the forest clearing and charcoal-making labor.

The whole of the furnace operations, including the management of the smelting and forging laborers, should be exclusively confided to Mr. Davies; but all his *accounts* would be rendered to Mr. Barratt, through Messrs. Gray and Thomas.

8. I trust that this plan will meet with the approval of His Honor. Its details may safely, I hope, be left to the discretion of the civil authorities.

I have the honor to be, &c.,

(Signed) J. H. BATTEN,

Commissioner.

Kumaon Commissioner's Office;
Nynee Tal,
The 14*th September* 1855.

(True Copies)

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

No. 1357.

FROM

C. BEADON, ESQUIRE,

Secy. to the Govt. of India,

TO

W. MUIR, ESQUIRE,

Secy. to the Govt. of the North-Western Provinces.

Dated the 26th October 1855.

HOME DEPARTMENT.

SIR,

I AM directed to acknowledge the receipt of your letter No 1917 A., dated the 22nd ultimo, on the subject of the direction of the iron smelting experiments in Kumaon, and in reply to state, that under the circumstances explained, the Hon'ble the President in Council approves of the intention of the Hon'ble the Lieutenant-Governor, to direct the construction of the smelting machinery at Dechowree instead of at Burralgaon, as the iron deposits at the foot of the hills are stated to afford a much more promising field of operations than those at the last-mentioned place.

2. These papers will be, as soon as possible, printed in a number of the *Selections from the Records of the Government of India,* supplementary to Mr. Henwood's Report.

I have, &c.,

(Signed) C. BEADON,

Secy. to the Govt. of India.

Fort William,
The 26th October 1855.

No. 2015 A. OF 1855.

FROM

WILLIAM MUIR, ESQUIRE,

Secy. to the Govt. of the North-Western Provinces,

TO

C. BEADON, ESQUIRE,

Secy. to the Govt. of India, Home Department,
Fort William.

Dated Head Quarters, Nynee Tal,
The 3rd October 1855.

PUBLIC WORKS DEPARTMENT.

SIR,

IN continuation of my letter No. 1917 A., dated 22nd ultimo, I am directed to transmit to you the accompanying copy of a

further analysis of Bhabur iron ores by Dr. Macnamara, Chemical Examiner to Government, and to request that it may be added to the Appendices of Lieut.-Colonel Drummond's Report, forwarded with my letter of the above date.

I have, &c.,

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

Head Quarters, Nynee Tal,
The 3rd October 1855.

(COPY.)

Further Analysis of Bhabur Iron Ores by Dr. Macnamara, Chemical Examiner to Government.

NAMES OF LOCALITIES.	Per-centage of Iron.
No. 1, Bhurgote, ...	50·1
„ 2, Shikarkola, ...	62·4
„ 3, Dhandoongra, ...	41·6
„ 4, Burrogar, ...	42·8
„ 5, Ditto, ...	53·3
„ 6, Ditto, ...	48·8
„ 7, Byalcheena, ...	54·6
„ 8, Ditto, ...	52·1

(Signed) H. DRUMMOND, *Lieut.-Colonel,*
On special duty.

Almorah,
The 28th September 1855.

(True Copy)

(Signed) W MUIR,

Secy. to the Govt. of the North-Western Provinces.

No. 2186 A. of 1855.

From

WILLIAM MUIR, Esquire,
Secy. to the Govt. of the North-Western Provinces,

To

CECIL BEADON, Esquire,
Secy. to the Govt. of India, Home Department,
Fort William.

Dated Head Quarters, Nynee Tal,
The 26th October 1855.

Public Works.

Sir,

In continuation of my letter No. 1917 A., dated 22nd ultimo, and with reference specially to its 7th para., I am desired by the Lieutenant-Governor to state, that he has now had a further close examination of the Dechowree and Loha Bhurbhur iron fields made under the direction of Lieutenant Greathed, Deputy Consulting Engineer, North-Western Provinces, who was preceded and has been assisted by Mr. Watson, of the Roorkee Work-shops. Mr. Watson was selected for the purpose, as being well acquainted with the nature and working of iron ores, by Lieut.-Colonel Baird Smith, Director, Ganges Canal Works, upon application made to that Officer by the Lieutenant-Governor.

Dated 20th Oct. 1855.
" 22nd Oct. 1855.
" 22nd Oct. 1855.

2. Three Reports, as noted in the margin, of which copies are submitted from Lieutenant Greathed, Mr. Watson, and the Commissioner of Kumaon, joined by Captain Ramsay, his Senior Assistant in the Province, and by Mr. C. B. Thornhill, C. S., a gentleman of some considerable practical conversancy with such subjects, satisfactorily establish the probable great extent and value of the beds of iron ore which have hitherto been reached and examined within the tracts in question. It is believed that an extension of similar beds of excellent ores will be discovered as the line of country along the hills may be further cleared and penetrated.

3. These Reports strongly confirm the Lieutenant-Governor in his views before reported of the advantage of directing the experimental smelting operations of this season to be conducted in the Bhabur tract. These operations will now be carried on in conformity with the suggestions which have been offered by Lieutenant Greathed. Immediate

measures will be taken to form water reservoirs in the upper levels, so as to admit of the continuance of the experiment to the latest practicable date in the ensuing hot season, and the jungle will be cut and cleared as rapidly as possible, so as to allow of the most complete and careful examination of the whole outer ranges and slopes of the lower hills by Mr. Sowerby.

4. The Lieutenant-Governor would request that the consent of the Managing Director of the East Indian Railway may be obtained to the retention of Mr. Sowerby's services during the whole of the cold season now commenced, with a view to a thorough exploration of all the Bhabur iron fields. The Supreme Government, in communication with the Managing Director, will be best enabled to determine what will be a fair and liberal rate of remuneration to assign to Mr. Sowerby when employed in this important duty. To this should be added a sufficient allowance to cover his travelling charges.

5. Mr. Sowerby will at once begin upon the proposed investigation, under the authority of the Chief Engineer of the Railway Company for these Provinces, by which he is permitted to remain in Kumaon until the 15th proximo. The Commissioner of Kumaon will be instructed to give every information and facility to Mr. Sowerby while so engaged, and he will be authorized also to give such assistance to Mr. Davies, in setting up his experimental furnace, as may from time to time be found requisite. On this point the attention of the Commissioner will be particularly called to the remarks in the concluding paras. of Lieutenant Greathed's letter. The amount of all such expenses to be reported in monthly statements for the sanction of this Government and the confirmation of the Government of India.

6. In my separate letter No. 2187 A. of this date, the views of the Lieutenant-Governor are submitted on the general subject of the arrangements to be adopted, in order to secure the working, on a larger scale, of the iron mines in the Kumaon Province.

I have the honor to be, &c.,

(Signed) W. MUIR,

Secy. to the Govt of the North-Western Provinces.

Head Quarters, Nynee Tal,
The 26th October 1855.

P. S.—The copy of a letter to the address of the Commissioner of Kumaon is also enclosed, requesting him to direct Captain R. Strachey, of Engineers, to select indiscriminately specimens of the ores from the several sites, in order that they may be forwarded for analysis to Calcutta.

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

(COPY.)

NOTES BY LIEUTENANT GREATHED, DEPUTY CONSULTING ENGINEER TO GOVERNMENT, ON EXAMINATION OF BHABUR IRON DEPOSITS AT DECHOWREE AND LOHA BHURBHUR.

Nynee Tal, 20th October 1855.

SIR,

I HAVE the honor to furnish, for the information of His Honor the Lieutenant-Governor, the following Notes of a visit to the Bhabur iron deposits of "Dechowree" and "Bhurbhur," made in company with Messrs. Batten, Alexander, Thornhill, G. Campbell, Colonel Drummond, Mr. Sowerby, Mr. Watson of the Roorkee Work-shops, who has had considerable experience in smelting works (charcoal) in Silesia, and Mr. Davies, the Welsh smelter, who accompanied Mr. Henwood from England.

Confirmation of Mr. Sowerby's Report as regards extent and position of deposits.

2. We examined carefully the Dechowree deposits from the first spot indicated* near the village to the bank of the Boer River, a distance of more probably than a mile; and I think my opinion, that Mr. Sowerby's Report, as regards the extent, position, and appearance of the deposits, is accurate and intelligent, was shared by all the gentlemen in our company.

* By Mr. Sowerby.

Sample of deposits seen.

3. We examined and verified every point mentioned in the Report, and in addition, were shown a discovery of the previous day, a wall of rock, pronounced by the mineralogists of the party to be a good ore, high up the hill, extending certainly 300 feet in length, and naturally denuded to a depth of 20 feet, without any ground of supposition that the floor of the deposit was attained.

4. Mr. Watson coincides with Colonel Drummond, Mr. Sowerby, and Mr. Davies, that the description of the rocks as iron ores, varying in characteristics in different places, in the manner detailed by Mr. Sowerby, is literally correct: to any observer cognizant of descriptive mineralogy, the weight, density, colour, and sometimes metallic lustre of the specimens taken at random along the whole length of the deposits, proclaim that he is standing on an iron field. I have myself never seen ore similar to that at Dechowree; but the poorer specimens of brown ore at Bhurbhur fairly resemble that which I have examined in the Shropshire iron fields.

Mr. Watson's opinion of the quality of deposit.

General opinion of those who examined.

5. Without entering into any question of probable percentages to be extracted from various specimens, I am unable to resist the conclusion that Dechowree presents a very large development of iron ore, pronounced by all the practical men who have seen it (save Mr. Henwood) to be exceedingly rich: that their opinion is supported by assays and analyses of Messrs. Macnamara and Piddington, referred to in the body of Lieut.-Colonel Drummond's Report of 15th August, as giving an average of over 40 per cent., and that the truth of the discovery bears every appearance of probability to any careful observer.

Conviction resulting.

6. The deposits already exhibited would, in the opinion of the practical man, supply very large works for a very long time; there is therefore no occasion to speculate on what may be discovered hereafter. The fact of what is known having been discovered under the disadvantage of the thick and continuous jungle now covering the slopes of a very steep hill augurs well for further developments.

Extent of deposits of iron ore.

7. The supply of lime need not I think be a matter of anxiety; the only lime-stone found *in situ* with the iron is not of a very good quality to the eye; but the masses of good material lying at the surface give good promise of beds yet to be found, and the channel of the Boer draining the Cheenah range affords a constant supply. Moreover the ores themselves contain a good deal of lime.

Lime.

8. The neighbouring forest is as thick as a forest can almost well be; as fuel for works in other countries *is supplied* by adjacent forests; as the oak, sal, and other

Fuel.

hard woods here found afford the best charcoal; and as local experience alleges that the re-production of timber fit for charcoal takes place in about eight years, there can be but little doubt of the capability of the forest, within a reasonable radius of Dechowree, to supply fuel for any works which will be erected. A very fine white clay, pronounced by Mr. Davies, the smelter, after experiment, to be a very good fire clay, is abundantly shown in several of the high scars on the hill side.

Motive power for large works.

9. Steam must be the motive power in any large works in this neighbourhood. The discharge of the Boer in March and April is reduced to from 7 to 10 cubic feet per second, and though the available fall is very considerable, and measures might be adopted materially to increase the present supply, there can be no reasonable expectation of obtaining water power sufficient to turn the machinery of works established on that sufficient scale which alone can fulfil the requirements of the country and develop the resources of the spot.

Site of permanent works.

10. The most favorable site in the neighbourhood of Dechowree for the erection of large permanent works appears to be on the lands of "Pithoreah," occupying the spur which confines the Boer River on the N. W., at its entrance into the Dhoon. The beds of ore at present discovered are on the opposite side of the stream, but the river is always fordable, save in floods, and the passage of ore would be easy on men's backs, whilst in the transit of manufactured iron to the plains, the crossing of the Boer inevitable from Dechowree would be avoided from Pithoreah, and the road might throughout be perfectly easy for wheeled carriages. There is a considerable cleared plateau on this spur, perhaps 500 feet, (300 higher than Dechowree), above the river, which would afford a more healthy building site for residences than Dechowree can offer, though, in the latter place even, Colonel Drummond and Mr. Sowerby have been pitched for several days without any illness in their camp. At Pithoreah the works would be immediately adjacent to this plateau, whereas at Dechowree the spur proposed for the residences of Europeans, now covered with forest, is steeper, more distant, and less accessible from the level ground. At Pithoreah, too, there is good water all the year round. Within a mile of it is Kotah, a village and thannah in the centre of the Dhoon clearance, where people reside all the year, available for residence if Pithoreah fails.

11. For purposes of immediate experiment, if such be determined on, Pithoreah, in addition to the advantages above cited, possesses that of ready-made water-courses leading through its lands, from one of which a fall of 50 feet might at once be obtained for the water-wheel, whereas, on the Dechowree side, the expense and delay of making a "Gool," 3 miles in length, must be incurred.

Site of experimental works.

12. I quite agree in the selection of site for a trial furnace made by Mr. Davies and approved by Mr. Sowerby. It must always be borne in mind, and everywhere proclaimed, that the experiment to be established this year, if imperfectly successful, is not conclusive; it would hardly be brought to practical commencement before January; it will probably be terminated by the cessation of water in March; the apparatus extemporised on the spot is necessarily rude; the execution of the work necessarily entrusted to a man who, perfectly zealous and honest though he be, as well as experienced in his calling, is not accustomed to depend solely on himself as he must now do; and it will require a continuation of the cordial support of Government, until the iron has been produced in a large scale, to overcome the prejudice and distrust which a partial failure now might create. Still it is a good thing done when *any* pig-iron is produced, and the experiment is at least a cheap one. *This season* it cannot be done on a larger scale.

Disadvantages under which the experiment will be carried on, and precautions necessary therein.

13. Under Mr. Watson's advice I recommend the smelter's being allowed to carry out, in the first instance, his own plan—of a furnace in which he has confidence, and of whose working he has knowledge: it would be advisable to have a second furnace built adjoining the first one, on its completion to be animated by the same wheel and same blow-pipe, in case—not improbable—of vent choking on the first experiment, which involves the taking down of the furnace, and would, but for the suggested precaution, bring the experiment to an end.

Scheme recommended for experimental trial.

14. It appears desirable, that even for this year's use, the waters of the Boer should be dammed up, not only at the head of the Pithoreah Gools, where I saw that the high banks of the river admit of a bund 12 or 15 feet high, but also higher up, wherever facilities offer; so that the possible time in which the experiment can be

Advocates recognizing the waters of the Boer, even for the experiment.

made may be extended. The bunds can be formed of open cribs, formed of rough poles nailed together at intervals, filled with boulders and backed with gravel and brushwood, on the method employed at the various Canal Heads.

Method of doing so.

15. It would be well that Mr. Watson should be referred to, and even sent for if necessary, in case of Mr. Davies coming to any difficulty. I would not recommend the formation of an European staff for this year's operations, as I heard proposed; Mr. Davies, with any available local assistance, will be able to get on; and employing soldiers, save under the eye of a resident superior, is very inexpedient.

Assistance required to smelter.

16. I strongly recommend the burning of the jungle of the Dechowree and Pithoreah hills when the season admits, and their exploration by competent people when so cleared, who might then be able to define the positions and extent of the several beds.

Further exploration and definition of beds desirable, (independent of smelting operations.)

17. The examination of Loha Bhurbhur equally confirms the accuracy of Mr. Sowerby's Report; the beds are not yet so well developed here as at Dechowree, being seen *in situ* but once (35 feet in depth and no bottom,) and the ores are pronounced to be less promising than at Dechowree; still a vast deal of mineral wealth is disclosed. This hill also should be burnt and thoroughly explored. No lime-stone has yet been found in it, and it may probably have to come seven miles from the quarries in the lower range West of Kaleedoongee. The ground near the new Kaleedoongee bungalow, where water is available and works might probably be established, is less clear and lower than at Pithoreah, so that the latter appears as superior for the site of an experimental work as the alleged superiority of the ores makes it promise to be for the first establishment of a permanent one.

Loha Bhurbhur.

Reasons for preferring Pithoreah in the first instance.

18. Mr. Sowerby purposes continuing his researches along the sandstone formation, more especially in the neighbourhood of the principal streams, water in juxtaposition to ore being the present desideratum. He has now proceeded to examine and report upon Huldanee.

Mr. Sowerby's movements.

19. In case of the experimental furnace being constructed at Pithoreah, early arrangements for supplying the smelter with carpenters, sawyers and smiths for the furnace, miners and coolies for the excavation of ore and lime-stone, are essential to the smelting being achieved before the water fails.

Necessary arrangements in case of experiment being decided on.

(Signed) W. H. GREATHED, *Lieut.*,
Depy. Consulting Engr. to Govt.

N. B.—In this Memorandum the word *Pithoreah* is an erratum for Putulia, but the Hill people use *l* and *r* indiscriminately in speaking—hence the mistake.

(Signed J. H. BATTEN,
Commissioner.

(True Copy)

(Signed) W. MUIR,
Secy. to the Govt. of the North-Western Provinces.

(COPY.)

To

THE HON'BLE MR. COLVIN.

HON'BLE SIR,

I HAVE the honor to inform you that I returned from an inspection of the iron mines of Loha Bhurbhur and Dechowree on the 19th instant, after having spent some six days in the vicinity of them, and made a strict examination of the ores. It is with great satisfaction that I have to report that they are of a very superior quality, as also very extensive.

Loha Bhurbhur is an extensive iron field; the ore is to be found in large masses on the side of the hill for about a mile in length by 220 to 230 yards in breadth, and also the blocks I came upon in that distance were solid masses of iron-stone. Some of them, if smelted, would yield upwards of 3 tons of pig-iron.

It is a rich brown iron ore, with a slight quantity of lime in it; is very heavy in the hand, and I should say, would yield from 45 to 50 per cent. of iron.

Where excavations have been made, the bed is exposed to a depth of from 15 to 16 feet of solid iron ore. Several excavations have been

made, but the rains having filled them up to a certain extent, part only of the bed is exposed. However, enough is to be seen to show that it is the same strata that extends all along the foot of the hill. It is also again seen in the ravines, of which there are several in the distance mentioned.

A red clay ore is also found above it; it is not so rich, but will be found of great service in the fusion of the richer ores in the furnace.

Lime is not to be seen in the immediate neighbourhood of the iron ore, but I understand it is to be had some four miles from Bhurbhur.

Dechowree is also a very valuable iron field. The ore is of a red colour, remarkably heavy in the hand; some of it appears to be richer than the Bhurbhur ores.

In situ it is exposed to a thickness of from 35 to 40 feet; when fractured the crystals are much more vivid than in the Bhurbhur ore. I should say that the richer of the Dechowree ores, found in the lower strata, would yield upwards of 50 per cent. of iron.

Huge masses of iron-stone are to be seen in all the ravines, all along the side of the hill, of which there are a great many in the space of about three-quarters of a mile in length, some of which extend down to the River Boer, some 200 to 250 yards in length, more or less, according to the bend of the river.

The ore *in situ* is much better seen at Dechowree than at Bhurbhur, as solid walls of it are exposed, which appear at some time to have been very slightly moved. Cracks in the strata are observed, but to no great extent. There also appears to be a greater variety of ores at Dechowree; the clay ores are, as far as I have seen, more predominant, which ores will be found to yield a fine liquid foundry iron, and, as before stated, be of great service in assisting the fusion of the richer ores.

Lime is also to be found in quantity at Dechowree, along with the iron ore, in the ravines; also a fine bed of fire clay, above and below the clay ores; neither of which are to be seen in the immediate neighbourhood of Bhurbhur.

For the erection of blast furnaces I should give Dechowree the preference.

Fuel is abundant of the very finest kinds for the manufacture of charcoal, the greater part of the forests being hard wood, which is considered the best for the manufacture of pig-iron.

I consider, from what I have seen of the Dechowree mine, that there is sufficient ore to keep four blast furnaces in work, melting at the rate of three tons per day each furnace, for the next fifteen years. When I say so, I consider that I under-estimate the amount, for when the dense jungle is cleared away in the neighbourhood of the mine, there is little doubt that more iron will be discovered.

And with attention to the surrounding dense forests, fuel in proportion.

I have, &c.,

(Signed) JAS. T. WATSON,

Assistant Engineer, Roorkee Work-shop.

Nynee Tal,
The 22nd October 1855.

(True Copy)

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

REPORT ON THE IRON MINES OF KUMAON AND GURHWAL.

THE following observations are intended to record the impressions produced by a careful examination of the iron deposits at the foot of the outer range of the Kumaon Himalayas, in the vicinity of the Eastern boundary of the Kotah Dhoon, with reference to their extent and the local facilities which exist for extracting the metal on the spot at which the ore is found in greatest abundance.

2. In arriving at the conclusions about to be stated, we have been assisted by the practical knowledge of Messrs. Sowerby, Watson and Davies upon those points which, without such aid, we should have been incompetent to offer an opinion.

3. We commenced our examination under the guidance of Colonel Drummond, at a point a short distance to the West of the villages of Deh and Chowree, the former of which is inhabited by cultivators throughout the year; the latter has been abandoned.

4. The lower slope of the hill was found to be covered with dense and luxuriant vegetation; the forest trees are in vast abundance, and the lower growth of shrubs and jungle is so compact and continuous as to render it difficult to effect an accurate exploration.

5. We found the surface of the ground among the trees covered by detached masses of rock, varying in size from small stones to masses containing several cubic yards.

6. On breaking these rocks they were seen to be of a rich reddish brown colour, the fragments of which were exceedingly heavy.

7. This, we were informed, was iron ore containing by assay from 30 to 60 per cent. of metallic iron.

8. Advancing up the slope of the hill, we arrived at a perpendicular ledge of the same formation, which, from excavations, was found to extend to a considerable depth below the surface, but to what extent we were unable to ascertain.

9. The exposed face of the perpendicular cliff was in some places upwards of 30 feet in height, and although the undisturbed surface of the hill concealed the formation on the right and left, the recurrence of these denuded beds at intervals on apparently the same level leads us to conclude that they form portions of one and the same formation.

10. The examination of this section of the country occupied us during four hours, and in that time we passed over such extensive tracts which were covered with exposed masses of iron-stone lying upon the surface as to lead to the impression that their removal would be an operation which could not be accomplished even with an extraordinary amount of labour within a term of many years.

11. Hence we are led to conclude, that works conducted upon the most extensive scale would be amply supplied for many years with the ore upon the surface alone, without the necessity for any mining operation being commenced.

12. We are also impressed with the belief, that the beds of iron ore which are found *in situ*, contain an amount of metal which is rarely found in any part of the globe.

13. In the vicinity of the exposed surface of one of these beds, a portion of the hill-side has been washed down, and the section exposed discloses throughout the greater part of its extent a mass of yellowish clay, which we are informed is a highly refractory fire-clay, of the description which is employed for making the bricks with which the inside of the smelting furnace is lined.

14. The formation in which the bed of ore is placed is apparently a sand-stone, which would work readily and be highly useful as a building material.

15. Lime-stone is also found in abundance.

16. The vicinity of Dechowree contains therefore iron ore, lime-stone, fire-clay, sand-stone and fuel in vast abundance; we are also informed that the comparative poverty of some portions of the ore is a circumstance of great importance, as it renders the use of a flux almost unnecessary, and greatly adds to the intrinsic value of the metal produced by the admixture of the poorer with the richer ore.

16. The village of Deh being the permanent residence of several families proves that no malaria exists which would render the establishment of permanent works impracticable, especially when the jungle shall be cleared.

17. Having satisfied ourselves of the existence of the ore, and of all other requisites for its reduction, we then proceed to investigate the extent of the water power which could be rendered available in the immediate vicinity.

18. The Boer River runs on the base of the slope which contains the ore. It is however doubtful whether the permanent stream is of sufficient volume to supply the requirements of a single furnace.

19. There appeared to be a discharge of about 100 cubic feet of water a second at the time of our visit, but we were informed by the inhabitants of the adjacent village of Putalia on the right bank, that in the month of April the whole of the water is diverted from its bed for the purpose of irrigating their lands, and we cannot estimate the discharge at that time above 7 cubic feet.

20. Mr. Sowerby suggested that some considerable supply of water for employment in the dry season could be procured by storing the supply of the rainy season in appropriate reservoirs, by the formation of a series of embankments to divert a portion of the floods. This would, in his opinion, be an useful auxiliary, though for extensive furnaces *at this point* steam machinery would still have to be looked to. The suggestion appears worthy of consideration.

21. Meantime there appears every reason to believe that Mr. Davies, the smelter, is perfectly competent to construct a water-wheel and blowing apparatus which would enable him to produce pig-iron before the diminution of the volume of water attains its maximum; and as the necessary works for permanent and continuous smelting operations could not be completed before the commencement of the next hot season, we are of opinion that the solution of the question of the practicability of

producing pig-iron may be regarded as the most important result of the preliminary operations which are now possible in this season, and we would therefore venture to recommend that nothing beyond this be attempted in the present year.

22. We also hope that the services of Mr. Sowerby may be available for examining the whole Bhabur iron deposits, and also making *at once* an experiment for holding up and retaining the water of the Boer River at and above the point where it now leaves the high range and enters the Kotah Doon, and whence the uppermost water-course of Putalia is now taken off. If he succeeds even with kutcha embankments in preserving some of the water now abundant in the river bed at the point in question, Mr. Davies may very possibly be able to carry on his smelting experiments of the present year to a later date than is now anticipated. We shall at all events attain a thorough knowledge of the capabilities of the river in the hot season in its ordinary state, that is, without the retention of the monsoon floods.

23. Mr. Sowerby will not be able to complete the thorough exploration, which is now imperatively called for, of the entire Bhabur face of the lower Himalayan ranges, until the close of the cold season now commencing.

(Signed) J. H. BATTEN.
„ C. B. THORNHILL.
„ H. RAMSAY.

The 22nd October 1855.

(True Copy)
(Signed) W. MUIR,
Secy. to the Govt. of the North-Western Provinces.

(COPY.)

No. 2184 A. OF 1855.

FROM

WILLIAM MUIR, ESQUIRE,

Secy. to the Govt. of the North-Western Provinces.

TO

J. H. BATTEN, ESQUIRE,

Commissioner of Kumaon.

Dated Head Quarters, Nynee Tal,
The 26th October 1855.

N. W. DEPARTMENT.

SIR,

I AM directed by the Hon'ble the Lieutenant-Governor to request that you will instruct Captain Strachey, now on leave in the Kumaon hills, to visit the locality in the Bhabur where iron has lately been discovered, and to select specimens of the ore *in situ* taken indiscriminately and of considerable size, from the several positions of Dechowree and Loha Bhurbhur.

2. The specimens should be labelled with a note of the spot from which they were taken, and packed saparately in boxes, in order that they may be sent for analysis to Calcutta.

3. When the specimens have been completed and packed, you will take steps for transmitting them for that purpose to the Chemical Examiner in Calcutta.

I have, &c.,

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

Head Quarters, Nynee Tal,
The 26th October 1855.

(True Copy)

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

No. 2187 A. of 1855.

From

WILLIAM MUIR, Esquire,
Secy. to the Govt. of the North-Western Provinces,

To

CECIL BEADON, Esquire,
Secy. to the Govt. of India, Home Department,
Fort William.

Dated Head Quarters, Nynee Tal,
The 26th October 1855.

Public Works.

Sir,

With reference to my letter No. 1917 A., dated 22nd ultimo, and to my separate letter No. 2186 A., of this date, on the subject of the extensive formations of iron ore discovered in the Bhabur tracts of the Kumaon Province, I am desired to submit for the consideration of the Supreme Government a letter of the 19th ultimo, from Lieut.-Colonel H. Drummond, forwarding an outline sketch of lease to a Company to be formed for the working of the mineral resources of Kumaon and Gurhwal. With these are transmitted a Report, No. 361, dated 15th instant, and enclosures from the Commissioner of Kumaon, stating his sentiments, and those of the Officers consulted by him, on the terms of the proposed lease, and a Memorandum by Lieutenant Greathed, Deputy Consulting Engineer to Government, North-Western Provinces, setting forth his views on the same subject.

2. The question of conferring an exclusive grant for working all the mines and minerals of the Kumaon Province to a single Company is one mainly for the consideration of the Hon'ble the Court of Directors. It does not seem to the Lieutenant-Governor that it would be prudent or desirable to make such a concession at present, when the true character of the mineral resources of the Province in question is only beginning to be accurately ascertained.

3. If such a concession should be made, it ought, in the view of the Lieutenant-Governor, to be accorded only on a large amount of capital being paid up, and on some strict condition for a substantial amount of forfeiture being included in the lease to provide for the contingency of a failure to produce a specified quantity of mineral ores within a fixed reasonable time.

4. In the event also of such a concession being sanctioned by the Home Authorities, the detailed remarks on the proposed terms of lease, which are contained in the Commissioner's letter of the 15th instant, have the concurrence and recommendation of the Lieutenant-Governor.

5. But it appears to the Lieutenant-Governor that the most practical and certain method of directing the attention of capitalists to the working of the iron ores of Kumaon would be found on the example of an enterprise conducted on a moderate scale under the direction of the Government itself.

6. As it appears now to be placed beyond doubt, that extensive beds of a rich iron ore run along the outer ranges of the hills below the settlement of Nynee Tal, Westward to the Kotah Doon, a competent Officer might be selected by the Government of India, and sent to the spot, to make every necessary inquiry as to the total cost on which smelting operations upon some considerable scale might be established, on the assistance, in men and materials, requisite for the purpose, and on the comparative advantage and probable prospect of procuring some specified amount of supply of iron in that manner in reference to the expense at which the same amount of an equally good description of iron might be imported from England and placed in the Canal Workships and Depôts at Roorkee or in the Punjab.

7. If the Report of this Officer should be encouraging, he might then be ordered to proceed to England to make himself familiar with all the proper processes in the manufactory works there, and to return, say, by the beginning of the next cold season (*i. e.* of 1856-57,) with a staff of lmechanics and implements sufficient to carry out the plan within the imits which might be prescribed for it.

8. The success of an experiment upon this adequate, but not immoderate scale, would, it may be reasonably expected, soon lead to applications from private parties for the lease to them of portions, within such areas, as may be then thought the most suitable, of the tracts of mineral ore in the Province, both those in the outer Bhabur ranges and those in the interior, where the ore is undoubtedly very valuable, though at present without ready means of access, and consisting chiefly of the purer kinds, which require the admixture of others in order to their being worked with full facility and advantage.

9. Some preliminary and tentative procedure of this kind seems to the Lieutenant-Governor to be that which should be followed before such

a step is taken as that of committing the Government definitively to the lease to one association of capitalists of all the mineral resources of the whole Province.

10. The question is distinct as to the amount of remuneration fairly due to Lieut.-Colonel Drummond for the information which has been now acquired through the long devotion of his time and attention to the investigation of the mineral resources of Kumaon. His services in that respect, preserved into a successful conclusion through much delay and discouragement, have been such as will, it is believed, entitle him to the favorable and liberal consideration of the Supreme Government and of the Home Authorities.

I have the honor to be, &c.,

(Signed) W. MUIR.,

Secy. to the Govt. of the North-Western Provinces.

Head Quarters, Nynee Tal,
The 26th October 1855.

(COPIES.)

FROM

LIEUT.-COLONEL H. DRUMMOND,
On special Duty,

To

W. MUIR, ESQUIRE,
Secy. to the Govt. of the North-Western Provinces.

Dated Nynee Tal, the 19th September 1855.

SIR,

THE Hon'ble the Lieutenant-Governor is, I believe, aware, that during my visit to England in 1853 I was enabled to satisfy the Hon'ble Court of Directors of the practicability of inducing a Company of capitalists to embark in the project of developing the mineral wealth of the Province of Kumaon and Gurhwal, provided that it received the approbation and support of the Home and Local Governments.

2. The annexed copy of a letter from the Secretary at the India House conveys the assurance of the approbation and aid of the Hon'ble Court.

3. You are aware that more recent discoveries have rendered the prospect of success, which might be anticipated from the establishmen

of extensive iron works, so encouraging that the formation of a joint-stock Company may be regarded as a matter of tolerable certainty.

4. It therefore only remains for me to comply with that portion of Sir James Melvill's instructions, which direct that an outline of the mutual engagements to be entered into by the Hon'ble Court and the lessees of the mines should be submitted to the Hon'ble the Lieutenant-Governor for his approval and sanction.

5. The terms of the lease, which I have now the honor of submitting, might at first appear to contain concessions and privileges of a magnitude which would be injurious to the interests of the Government and the country, but I would beg to offer a few explanatory observations, which I think will place the matter in a different light and show that these terms will be productive of the greatest benefit, not to the Province of Kumaon only, but the whole of the North-West of the Indian Territory, as well as to the capitalists who propose embarking in the undertaking.

6. The area of this Province, though nominally 11,000 square miles, is uninhabitable throughout more than a quarter of its extent, which is occupied by eternal snow.

7. If the whole of this Territory had been a level plain, or even had it been intersected by roads, so as to be accessible to carts throughout its length and breadth, I should have hesitated before I proposed assigning the mineral contents exclusively to one Company.

8. It must, however, be remembered, that the interior of the Province is in many places inaccessible. The best roads at present are capable of being traversed only by ponies and mules, and the surface presents a constantly recurring alteration of lofty mountains and contracted valleys.

9. To supply extensive smelting furnaces, it is necessary that the ore should be abundant and accessible, and the latter of these conditions could not be fulfilled in the interior without a considerable outlay of capitals for roads.

10. The position which I am led to believe, large works could be profitably established at the commencement, is on the outer edge of the Himalayan range, immediately upon the plains. The supply of ore with all the requisite accessaries of fuel, lime-stone, fire-clay, and water power,

is there almost inexhaustible, but the limits within which these are found are comparatively circumscribed.

11. On the Eastern boundary in the neighbourhood of the Sardah, the climate is unhealthy for a great portion of the year; on the West, near the Ramgunga, the existence of iron ore has not yet been ascertained.

12. Again, the Sub-Himalayan or Bhabur ore, though of a description which is most favorable for being worked into railway bars and similar heavy materials, would require an admixture of the richer ores, the interior to render it adapted for the production of the finer description of metal.

13. For these reasons any iron works established at the foot of the hills would require the command of the mines in the interior.

14. The present state of our information leads to the supposition, that a field for the enterprize of more than one Company has not yet been developed; but even if this supposition should be incorrect, I would beg leave strongly to urge the following points upon His Honor's consideration.

15. The successful application of capital in any undertaking, of the nature of that which is now contemplated, must depend almost entirely upon the character and intentions of those by whom that capital is furnished.

16. With the facts which are now about to be laid before the public, I believe no difficulty would be experienced in getting up a Company, but the probability is, that the individuals who took shares would have no intention of retaining them. Their only object would be to create a feeling in favour of the speculation and then sell their interest in it at a premium —in other words it would degenerate into a stock-jobbing bubble.

17. Such speculators would perhaps be comparatively indifferent as to the existence of a rival Company. It might not interfere with their object, which would be obtained when the market price of the shares would rise to a point which would enable them to sell out with profit.

18. But the case would be very different if the chief supporters were men of known integrity and wealth, who embarked with the honest purpose of deriving a legitimate return for the strict fulfilment of the engagement into which they had entered.

19. Such men would not risk their money in an undertaking which was to be rendered hazardous and fallacious by the tricks of competition, and I am confident that these merchants and capitalists, who had already supported one, would at once decline any participation in such an undertaking.

20. The working out of the undeveloped mineral resources of the Province would also be better accomplished by one Company than by many, inasmuch as the profits of one class of minerals would cover any losses they might sustain in others, and the whole being free from competition on the spot, they would have no clashing interests to retard their progress.

21. The whole of the minerals also being under one Company would render the management much simpler and freer from complication to the Government than it otherwise would be if several rival Companies were established, and the Government being secured in a fair proportion of the profits of the undertaking, makes the granting of the lease a business transaction, showing neither favour nor undue preference.

22. In preference to the whole Province, I may also mention that it is but one of the many mineral districts of India of equal extent and most probably fully as rich which might be made the ground-work for other Companies, and the successful establishment of this would be the forerunner of similar undertaking elsewhere.

23. The object of the Government being to secure the expenditure of capital in developing the resources of this Province, I think that the terms of the proposed lease will fully insure this. A minimum capital of £200,000 is guaranteed, £20,000 is to be expended within the first two years, in the erecting of iron works and the other minerals which are still unknown or at least but partially made use of, are to be the object of a special and separate expenditure, whilst the rights and interests of the cultivators and proprietors are secured.

20. I trust, therefore, that the proposals which I now have the honor of submitting, will be deemed satisfactory to the Hon'ble the Lieutenant-Governor.

I have, &c.,

(Signed) H. DRUMMOND, *Lieut.-Colonel,*
On special duty.

Nynee Tal,
The 19*th September* 1855.

FROM

JAMES C. MELVILL, ESQUIRE,

TO

MAJOR DRUMMOND.

Dated 9*th July* 1853.

SIR,

I HAVE laid before the Court of Directors of the East India Company your letter dated the 20th ultimo, stating that you have submitted to parties in this country the information you obtain on the spot, relative to the mines of Kumaon and Gurhwal, and expressing your belief, that on the concession of terms based on a Memorandum by the Lieutenant-Governor of the North-Western Provinces, which you enclosed for the Court's information, the co-operation of capitalists might be obtained for working the mines in question.

In reply, I am commanded to state, that the Court regard with great interest the development of the rich mineral resources of Gurhwal and Kumaon, and would be prepared to afford every facility and to grant any reasonable privileges to a Company formed for the purpose of carrying out the object. The Court do not object to the principal assumed by Mr. Thomason as the basis of the arrangement he contemplates, *viz.*, the grant for a limited number of years of the exclusive right of working the mines in the Districts in question on the European method; but before any definite arrangement could be formed, it would be necessary to make a reference to the Local Government, in order that the requisite provisions may be framed, among other objects, for guarding the existing rights of the land-owners and other natives of the country, for ensuring the effectual working of the mines during the existence of the leases, and for securing to the Government a due participation in the profits of the undertaking after it shall have been a reasonable period in operation.

I am, &c.,

(Signed) JAMES C. MELVILL.

(True Copy)

(Signed) H DRUMMOND, *Lieut.-Colonel,*

On special duty.

PARTICULARS OF A LEASE OF THE MINES OF KUMAON AND GURHWAL, TO BE GRANTED BY THE HON'BLE EAST INDIA COMPANY TO A COMPANY OF CAPITALISTS DULY CHARTERED BY THE BOARD OF TRADE, WITH A MINIMUM CAPITAL OF £200,000.

Submitted for the approval of the Hon'ble the Lieutenant-Governor of the North-Western Provinces, by Lieut.-Colonel Drummond, in accordance with the tenor of a letter to his address from the Secretary, East India House, dated 9th July 1853, *and of a letter to the address of the Secretary to the Government of the North-Western Provinces, from the Secretary to the Government of India, dated the* 19*th January* 1855.

SUBJECTS OF DEMISE.

ALL mines and minerals of every kind (except lime-stone) and other building materials, to which an exclusive right is not conveyed, in, under or upon the lands of the Territory known as British Gurhwal and Kumaon (except also the mines which belong to any temple,) with full power to get and work and carry the same subject to the zemindars' rights, in respect of the surface land, and making compensation to them for the use of such lands and for all damage done thereto, and for the purpose aforesaid, full power and privilege to use all waste and other lands of the Company, and all streams of water in the Territory aforesaid, within the limits assigned, except those streams which are used or required for purposes of irrigation, the control of which the Government retains in its own hands, and also to cut, use and consume all forest timber and other trees and jungle belonging to the Company within the limits assigned and marked off on the Territory aforesaid, except timber trees, namely, the saul and the sissoo.

2. *Term.*—Fifty years determinable as after mentioned.

3. *Rent.*—For the first two years at a pepper corn, and afterwards at a rent of Rupees 3,000 per annum, whether any royalties become payable or not, but such rent to be taken into account as a payment on account of royalties, payable at any period after the first two years.

4. Also at a royalty of 3 per cent. upon the average market price on the spot of all pig-iron manufactured at any time during the said term, commutable for a payment of one rupee per ton upon all pig-iron manufactured at any time during the said term, the said rent of Rupees 3,000 being taken into account as in payment or part payment, of royalties payable after the first two years.

5. Also at a royalty of 5 per cent. upon the gross value of all copper, lead, silver, plumbago, and every other mineral, except iron raised and gotten within the Territory aforesaid, the said rent of Rupees 3,000 being taken into account, in respect of such royalties, jointly with those on pig-iron.

Covenants by Lessees.

6. To pay rents and royalties reserved by the lease.

7. To lay out, within the first two years of the said term, £20,000 in the establishing of works and machinery for the working and smelting of iron ore and iron-stone; also effectually to dig for, raise, get, work and manufacture iron ore and iron-stone, so as to produce within the fifth, or some one earlier year of the said term, 2,000 tons at the least of manufactured pig-iron, and within the tenth or some one earlier year, and in every year subsequent to the tenth of the said term, 5,000 tons at the least of manufactured pig-iron.

8. To lay out, within the first five years of the said term, £10,000, in searching for, raising, getting or manufacturing some one or more of the minerals included in this lease not being iron or iron-stone.

9. To keep regular accounts of all iron ore and iron-stone got and worked, and of all pig-iron manufactured, and of all other minerals raised, and gotten, and to verify such accounts in the usual way, and to permit inspection of mines and works by the lessor's agents duly appointed.

Provisions.

10. For determining the said lease by the lessor's or the lessee's failure to perform the covenants aforesaid.

11. By the lessee's on payment of one year's rent of Rupees 3,000 in advance.

12. In case of determination of the lease by either party, all works and machinery to be the property of the lessees, with full powers to sell the same within three years, and for that purpose to have the use of any land of the Company and all other reasonable conveniences, with an option to the lessors to purchase at a valuation.

13. For enabling the lessees to obtain the occupancy of surface lands necessary for the prosecution of their operation.

14. All rights of zemindars in surface soil, which the lessees may desire to occupy, shall be negociated for them by the Commissioner of the Province, or other Officer appointed by the lessors, from whose decision

an appeal shall lie to the Lieutenant-Governor of the North-Western Provinces, whose decision shall be final.

15. Provided always that no lands used exclusively for cultivation shall be made over to the lessees, except by and with the consent of the Zemindars.

(Signed) H. DRUMMOND, *Lieut.-Colonel,*
On special duty.

Nynee Tal,
The 19*th September* 1855.

(True Copies)

(Signed) W. MUIR,
Secy. to the Govt. of the North-Western Provinces.

(COPIES.)

NO. 361 OF 1855.

FROM

J. H. BATTEN, ESQUIRE,
Commissioner of the Kumaon Division,

TO

W. MUIR, ESQUIRE,
Secy. to the Govt. of the North-Western Provinces.

Dated Nynee Tal, the 15*th October* 1855.

SIR,

WITH reference to your letter No. 1913 A., dated the 22nd ultimo, I have the honor to report as follows:

2. As instructed I called on Captain Ramsay, Senior Assistant in Kumaon, for his opinion on the terms of lease for a Mining Company proposed by Lieut.-Colonel Drummond, and I now beg to submit his reply in original.

3. As Captain Richard Strachey, the distinguished Officer of Engineers, was passing through Nynee Tal with his brother, Mr. J. Strachey, formerly Senior Assistant in Gurhwal, and as both these gentlemen expressed their great interest in the subject under discussion, and were fully capable to form a valuable opinion upon it, I put Colonel Drummond's proposed lease in their hands and requested their consideration of its

contents. The accompanying Memorandum is the result, which I beg to submit for the perusal of His Honor the Lieutenant-Governor.

4. As I have not been directed to attempt the preparation of any amended form of lease in technical phraseology, and as such an attempt would undoubtedly end in failure, I think that my best course is to make Captain Strachey's Memorandum the basis of the few comments which I have to offer.

5. In regard to Clause 1 of the lease, I am of opinion that the substitution of the terms laid down in the 6th para. of the Memorandum is highly desirable.

6. In regard to the same Clause also, I agree with Captain Strachey, that a specification of the minerals granted is necessary: these should be

Copper,	Iron,
Lead,	Graphite (Plumbago,)

and I would add "coal and all other valuable minerals hitherto unknown "within the limits of their lease, of which the lessees may be the first "discoverers."

7. I concur with Mr. J. Strachey in excluding from the lease any mention of exempted temple mines, none such exist within my knowledge, and *all* mines are the unalienated right of Government.

8. In regard to Clause 4, the objection of Captain Strachey is valid. The royalty of 3 per cent. should be on the fair *selling price* of the month, to be determined by a reference on either side with an umpire chosen by Government. The 5 per cent. royalty of Clause 5 should be calculated on the *gross selling value* similarly determinable.

The power to commute the royalty should, I think, be at the option of the lessees. The commutation of 1 Rupee per ton appears fair, and indeed if the lessee company carries out its operations on the scale which is involved in the guarantee of the stipulated capital, the Government may expect to receive from the royalty, even at the 1 Rupee rate, Rupees 40,000 or 50,000 per annum by the fifth year of the lease. Be that as it may, we *cannot* make any exact calculations *now*, and the Government does not look for large profits to itself, but desires the development of mineral resources.

9. In regard to Clause 7, I concur with the Memorandum (para. 12.) The lessors having conceded so much have a right to demand from the lessees security for a *real equivalent*, otherwise the concession and monopoly would not be justifiable.

10. The proposed addition to Clause 8 meets with my entire approval. I solicit the attention of His Honor to the whole of Captain Strachey's 14th para.

11. I think that Clause 9 is sufficient. The addition proposed in the Memorandum might cause alarm, and there appears to be no good cause for it.

12. Clause 13 would be improved by the addition "according to the "existing laws and by means of the public Officers of Government."

13. In regard to Clause 14, I advocate its cancelment, as the existing laws are sufficient, but not on the grounds set forth by Captain Strachey in his 18th para.

14. I consider Clause 15 unnecessary. The existing Railway Lands Act might be perhaps quoted as applicable to cultivated lands, which the proprietors may not amicably give up, but which, according to the amended Clause 1, the authorities may decide to be *necessary* for the use of the lessees.

15. In regard to the proposal contained in the final paragraph of the Memorandum, I am of opinion that the Civil and Revenue Code now existing in Kumaon and Gurhwal affords ample protection to defendants, and that the proposed additional Clause is unnecessary.

16. I have nothing to remark concerning the Clauses on which my Report is silent.

I have the honor to be, &c.,

(Signed) J. H. BATTEN,

Commissioner.

Kumaon Commissioner's Office,
The 15*th October* 1855.

No. 39 of 1855.

From

Captain H. RAMSAY,

Senior Assist. Commissioner, Kumaon Proper,

To

J. H. BATTEN, Esquire,

Commissioner of the Kumaon Division.

Dated Kumaon, the 28*th September* 1855.

Sir,

I have the honor to acknowledge the receipt of Secretary to Government's letter No. 1913 A., and accompanying correspondence received with your dockets No. —

I would suggest that the part of the 1st para. of the lease noted in the margin be omitted altogether; it appears unnecessary to the efficiency of the lease, and without it there is *no* condition which can by any possibility interfere with the rights of the zemindars or other natives.

"For the purposes aforesaid full power and privilege to use all waste and other lands of the Company, and all streams of water in the Territory aforesaid within the limits assigned, except those streams which are used or required for purposes of irrigation, the control of which the Government retains in its own hands."

I have the honor to be, &c.,
(Signed) H. RAMSAY,
Senior Assistant Commissioner.

Kumaon;
Senior Assist. Commr's. Office,
The 28*th September* 1855.

MEMORANDUM ON COLONEL DRUMMOND'S PROPOSED LEASE.

ALTHOUGH Colonel Drummond's intentions, with respect to the terms of the lease to the proposed mining company, seem in general reasonable, there are some points of detail in which alterations appear to me desirable.

2. In framing a deed of this kind the conditions cannot be made too explicit. In the proposed draft, there are, however, many clauses which would confer rights and which might lead to results in no way contemplated, while there are some points omitted which ought to have been provided for.

3. *Clause* 1 is intended to specify the things leased—by it is given to the lessees an exclusive right, under certain conditions, to all mines and minerals of every kind, excepting lime-stone and building materials, and to use for their works all land belonging to the Government, all streams excepting those used for irrigation, and all trees and jungle except saul and sissoo.

In Colonel Drummond's lease there is a proviso, "excepting the mines which belong to any temple." This I suppose referred to Chorpucur, a mine in Dusolee. But neither in it, nor in any other mine, has any temple in reality any rights at all. I believe this to be clear and certain and the proviso should be omitted.
(Signed) J. STRACHEY.

4. These terms are much too wide. In the first place metals and minerals are really the objects of the contract; land, water and wood, are necessaries, the use of which had better be secured to

the lessees by a special clause in the deed. It is not necessary to assign to a mining company exclusive rights, which, if pushed to their legal limit, over-ride the property now held by Government in all the land, wood and water of the Province. Such would be the effect of the stipulations made in Colonel Drummond's deed, not a house could be built, a mill worked, or a tree cut without danger of infringing the prerogatives of the lessees.

5. All that is really necessary for the lessees is the occupation or use of such land, streams and wood as may be wanted for their mining operations, no general right of property in such things ought to be conveyed. The use of them should be specially conceded by the Government, under such restrictions as will insure their *bonâ fide* application to the recognized operations of a mining company.

6. Thus the Government might bind itself to permit, free of any charge, the use of all streams of water necessary for the works of the lessees, where such use would not interfere with established rights; also to make over to the lessees such land as may be necessary for the proper working of mines and the establishment of furnaces, buildings, &c., connected with them, or any experimental workings; also to permit the cutting of such wood as may be necessary for the supply of fuel. The necessity in such case for the use of either water, land or wood would be determined by the Lieutenant-Governor of the North-Western Provinces or the Officers appointed by him.

7. A grant of the exclusive right to work all minerals, excepting lime-stone and other building materials, appears to be inexpedient and unnecessary. By it the manufacture of an earthen pot would trench on the privileges of the Company, and to pick up a garnet or a specimen of rock crystal would be unsafe. The main object of the present contract is the exploration of metallic ores, and if the lessees wish to undertake any other operation, it should be distinctly stated. If for instance they propose to establish potteries or alum works, they ought now to say so. In short the Government ought clearly to know the extent of the monopoly they have conferred, and what are the undertakings which they have placed out of the reach of the rest of the community or even of themselves.

8. *Clause 3.*—The date of payment of the rent should be specified, say 1st October, being the beginning of the Fuslee year, as well as of the season's operations.

9. *Clause* 4.—The royalty is proposed in this clause to be calculated on the *average market price*, but there will be no market, except that of the lessees, and it is quite possible that all the pig-iron might be converted into castings, bars, &c., on the spot, and not come into the market as pig-iron at all. Will not *actual cost price* be better? By the next clause (No. 5) the royalty is to be calculated on the *gross value*. I don't know what this means.

10. Moreover is 1 Rupee per ton a fair equivalent to 3 per cent. on the average price or cost of pig-iron? It assumes a value of £3-6-8 per ton, or Rupees 1-3 per maund. It should be considered whether this is a correct assumption, nor does Colonel Drummond's draft define at whose option this commutation may have effect.

11. *Clause* 5 would require to be modified if the views expressed in para. 7 of this Memorandum be considered proper.

12. *Clause* 7.—Before this it would perhaps be better to insert clauses engaging the Company to raise a capital of at least £200,000, with the ordinary provisions for paying up a deposit on the shares, &c. Colonel Drummond, it is true, proposes to make the lease only after the formal constitutions of the Company, but the Government would, I think, have better security by making the raising of the capital, &c., conditions of the lease.

13. Although Colonel Drummond has not asked for any guarantee of dividend from the Government, it must be doubtful whether the English capitalists will be found ready to embark their money without such guarantee in an undertaking of this sort, on evidence which, especially after Mr. Henwood's Reports, must necessarily appear to them very unsatisfactory. But to provide iron has now become a matter of imperial necessity, assuming therefore that the Government will not itself work these mines, it becomes a question whether an endeavour ought not to be made by offering a guarantee of say 5 per cent. on terms similar to those granted to the Railway Company to clench the matter, and so actually ensure its immediate commencement of iron smelting on a large scale. This is of course said upon the assumption that the iron deposits of the Kumaon Bhabur are really as valuable as Colonel Drummond supposes them to be.

14. *Clause* 8.—After the words "£10,000," I would add "or such smaller sum as the Government of the North-Western Provinces may deem sufficient." It seems to me unwise to insist on so large a sum as

£10,000 being laid out in searching for other minerals besides iron; moreover, means should be provided for enforcing the outlay of whatever sum is stipulated. According to Colonel Drummond's draft the penalty would be the annulment of the whole lease. But as the working of iron is the main thing wanted, the Government would not be disposed to cancel the whole lease, if the Company satisfactorily performed the contract as regards the metal. It might therefore easily happen, that the lessees were allowed to retain the monopoly of working all other metals, although they might never spend a shilling on them; I would consequently suggest that the Local Government should have power to release the lessees, on their demand, from their engagements to spend money in searching, &c., for other metals to any extent it thought fit; that if the lessees did not fulfil their engagement (either in its original or modified shape) the Government should then be authorized to expend the balance on the same objects at the risk of the lessees, who should be made to bind themselves to re-pay the amount; and lastly, that if certain specified sums were not laid out on these objects within a specified time, the rights of the lessees to work metals and minerals other than iron should be voidable at the will of the Government.

15. *Clause* 9.—It seems desirable to give to the Government the right of inspection, not only of the works, but also of the books, accounts, plans and drawings. It might be provided that the Government should not make these public without the consent of the lessees.

16. *Clause* 12.—The clause, as it stands, is not sufficient. It is also necessary to provide for the case of the determination of the lease by expiry of the term.

17. *Clause* 13.—The Government having engaged to give what land is requisite, need here only stipulate further, that they will put the lessees in possession and will cause compensation to proprietors to be fixed according to the existing laws, for the payment of which the Company will be responsible.

18. *Clause* 14.—Any attempt to settle by this deed how disputes between the lessees and landholders are to be arranged is evidently futile, third parties being in no way bound by it. The existing laws, if properly acted up to, are surely sufficient for the protection of the people in such a matter as this.

19. *Clause* 15.—This clause virtually excludes land under cultivation from that to be considered available for the lessee's operations.

This seems unwise. The establishment of these mines will be of the highest public importance, and the Government may, without the least impropriety, take possession of whatever land may be actually required, probably a very small extent, under the laws actually in force.

20. Although no special provision to guard the rights of landholders seem necessary, still, considering the extreme ignorance of the people generally, it might possibly be expedient to guard against any caprice or litigiousness of the Company's agents, by inserting a clause binding the lessees not to institute any suit against any native subject of the Government on account of infringements of their exclusive rights in mining, &c., unless due notice has been given to the defendants, or unless it can be shown that the defendants were otherwise cognizant of those rights.

(Signed) R. STRACHEY, *Captain*,
Engineers.

Camp,
The 8th October 1855.

(True Copies)

(Signed) W. MUIR,
Secy. to the Govt. of the North-Western Provinces.

MEMORANDUM ON COLONEL DRUMMOND'S PROPOSED LEASE.

1. The proposal of granting a monopoly to any Company whatsoever, of the working of all minerals, in a Territory of 11,000 square miles in area, the only portion of the Indian Empire in which the conditions requisite to the profitable working of minerals has as yet been found in combination, appears to demand the deepest consideration. It can be assented to on one of two grounds only, *viz.* : 1—That the development of the resources of Kumaon cannot be so completely effected by any other means, or 2—That the action of a Company would be beneficial to the country and the community.

2. On the first ground, it may be allowed, that the action of a Company bound to fulfil a specific engagement in a specified time is speedier, easier to Government, and *possibly* more economical than the direct action of Government could be ; but in the absence of these conditions there can be no such result.

3. The direct interest of a Company, taking the proposed lease, would be to establish such (say) iron works as would enable it to supply the

minimum local demand, and no more, at such price as should just enable it, there being no chance of competition to under-sell the English manufacturer. This result isolates both the arguments in favor of a Company; it does *not* ensure the greatest possible development of resources, and it does *not* convey the greatest amount of benefit to the community, and on this account the bestowal of the gigantic monopoly required by Colonel Drummond appears to my mind most unadvisable.

4. The contract appears to be very one-sided. On the part of the lessees there is absolutely no penalty for the non-fulfilment of contract; but the termination of the lease—the very object which, under those circumstances, a Company would strive to obtain ! so it is quite possible, that after a Company had been pottering on for four years, (two allowed, one of grace, one in hope of improvement,) without doing any good to the country or the Government, and preventing the while any thing being done by others, the Government might find itself, in its present position, as regards the working of the mines of Kumaon, the worse for a destroyed prestige and an established prejudice.

5. If £200,000 is the limit of capital which can be raised by Colonel Drummond's agency, the field of his Company's operations should, I conceive, be very much limited. In any case the first step of a Company would be to send out its own Surveyors, before entering into any contract ; let it do so, let them pitch upon any number of mineral sites, the working of say one-tenth of which would fairly employ their capital, then give them absolute possession of the necessary extent of land liberally computed for the working ; if the mines are good for any thing, this is ample field ; if not, subsequent application for extension would doubtless be fairly entertained by the Government of the day, and the Company's prosperity thus maintained, without a whole Province being willed away.

6. Under the limited Liability Act, available capital is likely to increase largely, several Mining Companies might be established in Kumaon, operating most usefully upon one another.

7. Whatever the limitation of the sphere or extension of the capital of a Company or Companies (and they should bear some fixed relation) it appears to me essential that measures should be taken to avoid the maintenance of prices, which a monopoly, or, as in England, a combination of iron masters, might involve. Let it be a term of contract, that all surplus after 10 per cent. profit be devoted to lowering prices, which

should be fixed half-yearly under the sanction of Government. In Australia the Burra Burra copper mine was paying the other day 250 per cent. per annum, why should the Government incur the possibility of such results from discoveries made in their Territory, by their servants, at their costs, being lost to the country and gained by a Mercantile Company ?

9. It appears a natural process, that on a Report of mineral discoveries made by competent persons, and of the existence of certain facilities of working minutely described, going forth with the endorsement of Government, a Company should be formed who, paying half a crown a share or so, send out their own people to investigate facts and tender conditions. Without this Government security, upon the *ipse dixit* of a prosperous miner or nameless adventurer, numerous Mining Companies have been formed in Mexico, in California, in Australia, and this without the cession of a Province.

10. I would therefore urge, if the agency of Companies be employed, that their field should be in proportion to their capital ; their profits limited and Government supervision established ; if these demands entailed the grant of a guarantee, I would urge its concession. The Government knows the ground it is going on ; without a thorough knowledge of premises, it would refuse sanction to a Company. Secure of the success under its own supervision, of any authorized Company, let Government make the concession of a guarantee, which, in a few years, would cease to be a burden, in exchange for whose security, shareholders would consent to a restriction of their profits, entailing to the community the enjoyment of mineral products at a reasonable cost.

11. It is doubtful whether, under any circumstances at present to be anticipated, Government could forego forming an establishment for the production of iron for its own purposes. As public works increase and spread, the demand for machinery constantly increases, and at Roorkee, Futtehgurh, and the Baree Doab Head Quarters, new machines are constantly added to the shops, and larger works are successively undertaken.

12. With improved means of conveyance now arising, the amalgamation of all, or many of these, at the spot where iron and fuel are most abundant, would hardly be a question, save of time, if the iron were produced at any one place at a decidedly lower price than at others, the economy of centralising establishments and of carrying manufactured arti-

cles, rather than minerals, being undoubted. With a good production of iron, we have to look to the construction of iron ordnance and of shot and shell, all of which is now imported, being carried on in this country, of a great deal of Government work in short to be done on the metal necessary for whose construction Government would probably not wish to pay manufacturers' profits.

13. So that in case of there being any difficulty in forming Companies on the terms herein proposed, the formation of a Government establishment would, whilst attaining the same object of developing the mines of Kumaon, at the least possible expense to the country, be the *nucleus* of an establishment which will hereafter be required, the imperial demands upon which, would be large enough to enable it to abandon provision for the public to traders, whom its own success would after a short time attract.

14. In the establishment of a Government work, there would be no practical difficulty. A competent Officer, after making himself perfectly acquainted with the conditions under which the works will have here to be carried on, the nature of the ores, the nature of fuel, of fluxes, of labour, of water power, of climate, could, in the course probably of twelve months, visit all the establishments in Europe, in which iron is produced under *similar or analogous circumstances*, and return prepared with plans and with men to carry them out, thus giving a Government establishment a very great advantage over any private one, all of whose skilled artificers and superintendents would come out in total or rather practical ignorance for the circumstances under which they would have to work.

15. In conclusion, and in consideration of the above cordially agreeing, from experience of railway contracts in this country, with Captain Strachey, upon the necessity of having every term and condition stringently and precisely defined, and therefore subscribing to all modifications of the proposed contract suggested by the Commissioner of Kumaon, observing that the proposed 3 per cent. royalty, and commutation for 1 Rupee per ton, as option of lessee, not being shown to proceed from any established basis of calculation, should be strictly examined, as constituting the only immediate benefit to be derived by Government, the Lord of the Manor. I conceive that if mines are leased, they should be granted on the terms put forth in para. 10; that failing this, that a start should be made by Government; that either course is perfectly easy, and

that no circumstances should induce Government to sign away the monopoly, almost the fee simple of the Territories of Kumaon and Gurhwal.

16. Lastly, although the letter of the Court of Directors may have bound them to consider favorably under circumstances now entirely altered, the proposals of a Company organized by Colonel Drummond for the purpose of mining in Kumaon, it in no way prevents any operations anterior to the signing of such a lease as Government might be disposed to adopt.

(Signed) W. H. GREATHED.

(True Copy)

(Signed) W. MUIR,
Secy. to the Govt. of the North-Western Provinces.

No. 2193 A. of 1855.

From

WILLIAM MUIR, Esquire,
Secy. to the Govt. of the North-Western Provinces,

To

CECIL BEADON, Esquire,
Secy. to the Govt. of India, Home Department,
Fort William.

Dated Head Quarters, Nynee Tal,
The 27th October 1855.

Public Works.

Sir,

With reference to the proposals made in my letter No. 2187 A., dated 26th instant, the Lieutenant-Governor finding that the services of Captain Strachey, who, from his high qualifications and extensive local experience, is peculiarly fitted for the duty, are available, and that Officer being now on the spot on leave from his appointment as Superintendent of Works of Irrigation at Jhansie, has requested him to enter at once upon the enquiry into the circumstances of the Bhabur iron fields, with a view to the submission of the estimates of probable cost and return, which have been proposed in para. 6 of my letter above quoted.

2. A copy of the instructions this day addressed to Captain Strachey is annexed, and I am requested to solicit the confirmation of the Hon'ble the President in Council to the arrangement.

I have the honor to be, &c.,

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

Head Quarters, Nynee Tal,
The 27th October 1855.

No. 2194 A. of 1855.

From

WILLIAM MUIR, Esquire,
Secy. to the Govt. of the North-Western Provinces,

To

Captain R. STRACHEY,
Engineers.

Dated Head Quarters, Nynee Tal,
The 27th October 1855.

Public Works Department.

Sir,

I am directed to forward for your information the copy of a letter addressed to the Government of India, No. 2187 A., dated 26th instant, on the subject of enquiries contemplated by the Government, regarding the probable cost and advantages of establishing iron works on a moderate scale, under Government Officers, in the Kumaon Bhabur fields.

2. As you are now on the spot, and it is of great importance to save time in the preliminary investigation and formation of an estimate which will be required to carry out this purpose, I am desired to request, that instead of proceeding to rejoin your appointment at Jhansie, you will at once undertake the duty indicated in para. 6 of the letter above stated. The result of the enquiry you will report direct to this Office as soon as it may be completed.

3. You will be aware of the importance of framing estimates of expense, and fairly calculable return, such as are now required, with the greatest care and strictness, so as to guard against taking too sanguine a view of the result of such projected operations.

4. The instructions now communicated are not to be understood as anticipating in any measure the final decision of the question which will be formed by the Government of India. It will, under all circumstances, be of value to record the information, which it will be your object to collect and to submit to the Government in a clear and practical form.

I have, &c.,
(Signed) W. MUIR,
Secy. to the Govt. of the North-Western Provinces.

Head Quarters, Nynee Tal,
The 27th October 1855.

(True Copy)
(Signed) W. MUIR,
Secy. to the Govt. of the North-Western Provinces.

No. 2229 A. of 1855.

From
WILLIAM MUIR, Esquire,
Secy. to the Govt. of the North-Western Provinces.

To
CECIL BEADON, Esquire,
Secy. to the Govt. of India, Home Department,
Fort William.

Dated Head Quarters, Nynee Tal,
The 31st October 1855.

Public Works Department.

Sir,

In continuation of my letters noted in the margin, I am directed to forward, for the information of the Supreme Government, the accompanying copy of a letter from Lieut.-Colonel Drummond, dated the 23rd instant, with its enclosure from Mr. Watson, regarding the iron ore deposit of Durryal Kheree, a small ravine near Loha Bhur Bhur, which Mr. Watson was requested to examine on leaving the hills.

No. 2186 A., dated 26th Oct. 1855.
No. 2187 A., dated 26th Oct. 1855,
No. 2193 A., dated 27th Oct. 1855.

I have the honor to be, &c.,
(Signed) W. MUIR,
Secy. to the Govt. of the North-Western Provinces.

Head Quarters, Nynee Tal,
The 31st October 1855.

(COPIES.)

FROM

LIEUT.-COLONEL H. DRUMMOND,

On special duty.

TO

W. MUIR, ESQUIRE,

Secy. to the Govt. of the North-Western Provinces.

Dated 23rd October 1855.

SIR,

I HAVE the honor to forward to you a note I have this day received from Mr. Watson, Engineer of Roorkee, regarding the iron ore deposit of Durryal Kheree.

I have the honor to be, &c.,

(Signed) H. DRUMMOND, *Lieut.-Colonel,*

On special duty.

Nynee Tal,
The 23rd October 1855.

FROM

J. T. WATSON, ESQUIRE,

TO

COLONEL DRUMMOND.

Dated the 22nd October 1855.

DEAR SIR,

I HAVE had a good look at the Durryal Kheree mine, and it appears to me that the ore is just the same as at Bhur Bhur, but not quite so rich. It is lying on the hill-side in large blocks, the same as at Bhur Bhur. Though an out-crop of the one, and a further indication that the lower part of the low range of hill is covered with it, and I should say there is very little doubt but that it will be found in several places between Durryal Kheree and Bhur Bhur, if the ground were examined when the jungle is lower, as it is almost impossible to see any thing just now. From what I have seen of it, it covers a space of about 250

yards in length by 160 in breadth, and in no place did I see it to any extent *in situ.*

I am, &c.,

(Signed) J. T. WATSON.

Kaleedoongee,
The 22nd October 1855.

P. S.—Please forward this to Mr. Batten.

(True Copies)

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

No. 2363 A. of 1855.

From

W. MUIR, Esquire,

Secy. to the Govt. of the North-Western Provinces,

To

C. BEADON, Esquire,

Secy. to the Govt. of India, Home Department.

Dated Head Quarters, Camp Meerut,
The 20th November 1855.

Public Works Department.

Sir,

With reference to previous letters from this Department, regarding the Bhabur iron mines, I am directed to forward, for submission to the Hon'ble the President in Council, the copy of a Report on the subject by Mr. James Watson, Assistant Engineer, Roorkee Workshops.

I have, &c.,

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

Head Quarters, Camp Meerut,
The 20th November 1855.

(COPY.)

REPORT ON THE DEPOSITS OF IRON ORE AT LOHA BHUR BHUR AND DECHOWREE, MADE ON THE 1ST NOVEMBER 1855.

DECHOWREE IRON MINE.

THE plain on which the small village of Dechowree is situated is from about 200 to 250 feet above the level of the country or plain of Kotah Doon, through which the River Boer flows.

On the foot-path descending from the upper plain to the lower, on the North side of the river, large masses of iron-stone are to be seen in small ravines. In continuation of this, but some 300 yards or so higher up, where there has been some excavations, there is a bed of iron-stone exposed, of a thickness of some 8 or 9 feet, which is of a red color and is a very rich ore: when fractured, bright shining crystals are observed in it.

Continuing Westward there is another ravine, in which a great deal of iron ore is found, huge masses of it are scattered all over the surface of the ground. This ore is not so heavy in the hand as that found in the lower strata. Some 250 yards further on, there is another ravine, where the rains have washed the clay away. To some extent here the bed is very finely defined. Two solitary pillars are to be seen upwards of 35 feet high, and apparently go below the surface, to what extent it is impossible to say. The ore taken from the lower portion of these pillars is remarkably rich, and I should say would yield 50 per cent. of iron. Excavations have been made in this ravine, but I am told no bottom has been found. They had partly filled up with the late rains, so I had not a good opportunity of seeing them to advantage.

In several of the ravines, when the rains have washed away the bank, the strata of ore are to be seen *in situ*. They dip at a considerable angle into the hill and are of a red micaceous nature, not so rich, and perhaps will not yield more than 25 per cent., but they will be of service in mixing with the rich ores, as they will answer as a flux and assist the fusion of them.

At the foot of most of the ravines, gravel washed down from the bed of ore is to be found, which is of a workable quality.

Further Westward large masses of iron-stone are again seen lying on the surface of the hill-side, some of which it would be impossible to say of what size they were, as I had not the means of excavating to

ascertain to what extent the large masses were buried in the ground. Several I measured which were upwards of 10 feet long + 5 feet 6 inches, + 4 feet 6 inches, and one or two were upwards of that size. If smelted they would yield upwards of 3½ tons of pig iron.

By ascending the flux of the hill at this point, which is very perpendicular and over-grown with dense jungle, we came upon a wall of solid iron-stone, from which the huge masses seen by me below appear to have fallen. This wall is seen for a considerable distance, but I am unable to state that extent to which it penetrates inwards.

The distance traversed over from the first-mentioned point is about a mile in length, and it would be almost impossible to say what amount of iron ore there is in that distance. However, I feel confident that there is enough for four blast furnaces, melting at the rate of from 3 to 4 tons per day, each furnace constantly working for the next 15 years.

In another ravine that runs past the village on that same level, in which there is a flow of water, and from which the zemindars take the water for irrigation, the small canal or water-course which they have made is actually hewn out of solid iron-stone for some 15 to 18 yards in length. Excavations have also been made in this ravine, where the bed was exposed, I understand, to the depth of from 8 to 10 feet, but have silted up with the rains.

It is clear that these are the same strata that are seen in the first-mentioned ravine in descending from the village, as it strikes in upon it at an angle, but the jungle being so dense, it was impossible to ascertain the fact to a certainty.

About one and a quarter of a mile from Dechowree, near a small village named Gaga, to the Eastward, in a ravine, indications of iron are to be seen, but the bed is not seen *in situ*, although I picked up some very good bits of ore.

I saw some specimens of malleable iron made from the Dechowree ores by the native under Colonel Drummond; it has a very fair appearance, it bends hot without a fracture, and when bent cold the fracture is but very slight; indeed it requires nothing more than to be properly worked to make a first-rate iron, much superior to the generality of the market iron of England.

In several of the ravines large masses of lime are to be seen alongside of the ore; the lime formation can be at no great distance from them;

also some very good beds of white and blue clay, which might answer in the manufacturing of fire bricks, as it has every appearance of fire clay.

The River Boer

Flows within from 10 to 12 paces of the bed of ore; it is a considerable stream just now, but I am informed that we could not calculate on more than from 9 to 10 cubic feet per second during the dry season.

This would do for one or two furnaces at most, if a large diameter of water, which was employed with bunds to keep up a supply of water, a great amount of fall could be had by either going up stream or having the furnace lower down, but even then we could not get more power than would be sufficient for two furnaces.

I would propose that two high-pressure beam engines be employed, being much simpler than the hand-gearing engines, and not so liable to get out of order. Each engine to be of 32-horse power, which would be capable of producing from 3,600 to 3,800 cubic feet of air per minute connected. Should any thing go wrong with either one or the other of them, one could go on working under easy blast for four furnaces or two, as the case might be.

Sufficient water power is to be had to make an experiment on a small scale, with the assistance of a bund ; 'but to be dependent upon bunds to work four blast furnaces would be running a great risk.

The proposed site for the furnaces on the South side of the river, near the small village named Shahat, is a very good situation, provided that the funnel head of the furnace will admit of the mineral being delivered at the mouth without hauling up, which is attended with a great deal of trouble and expense.

Fuel is to be had in abundance in the Kotah Doon; above in the forest would afford fuel for about two years, being all level country ; it could be brought into cultivation, which would make it more healthy. The woods are all of the best kind for making charcoal, being bakeley, saul, dak, kyear, and others, which are too numerous to mention : among them are also to be found some of the softer woods, which would do for calcining.

Hard woods are preferred for fuel, as they stand a much stronger blast and consequently bring the mineral into a state of fusion much quicker and with a less amount of fall than softer wood.

In the charcoal furnaces of Germany, it used to take 3 tons 4 cwt. of pine charcoal to produce one ton of pig-iron—I should say with the

hard woods, which are considered to give 5 per cent. more heat, that two tons 5 to 7 cwt. of hard-wood charcoal would produce one ton of pig iron. But this depends much upon the kind of iron that is so smelted, the richer ores requiring more coal than the poorer.

Some of the timber is rather heavy and will require some labour to cut it up, but if the trunks of the heavy trees were cut down during the cold weather and barked, and then cut into heights of from 2 feet 6 inches to 3 feet, and exposed to a hot season's sun, they would, to a certain extent, split of their own accord, which would be a great saving of labour and the wood char much better.

When charcoal is made at a distance from the furnace, I should recommend that four wheeled waggons be used in the transporting of it to the furnace. A wicker-work basket is made and placed inside of a light frame work, it is elastic and does not break the charcoal, such are in use over the greater part of the continent where charcoal furnaces are in work.

It is my opinion that great improvement might be made in the native furnaces, that in reducing the iron from the ore into a malleable state in blooms, at a heat where very rich ore is to be found, such as the natives work. This I have little doubt could be done on a large scale, having seen the experiment made on the continent, which succeeded to a certain extent, was given up on account of the iron ore being too poor, not containing more than 35 per cent. of iron.

If such could be done the saving would be very great, as the iron would be in a fit state for the rolling mill at half the cost, not having to undergo the process of puddling—the only difference is, that in the one case coal was employed, in this charcoal would be used, which might not be used to such good effect as the gases from the coal assisted the combustion to some extent.

Loha Bhur Bhur.

The iron-stone is to be seen much in the same position as at Dechowree, lying on the slope of the hill in huge masses. It appears to contain more lime than the Dechowree ore, but is not so rich, nor is there such a variety of ores : however, it is a most valuable field of iron. It extends from about 220 to 230 yards in breadth by about a mile in length. Excavations have been made in some of the ravines more close to the new road ; the bed *in situ* is exposed to a depth of some 12 or 14 feet,

I understand it was much deeper, but had silted up. Some cracks are to be seen in the bed, but of no extent. The ore is a dark brown ore, heavy in the hand and appears to contain a good deal of iron.

Some little way to the West of this, and lower down the hill, another excavation has been made, where the bed is exposed to a thickness of some 10 feet, the ore in which appears to be very solid and richer than above.

Some 180 yards further on a shaft has been sunk, which has partly filled up again; at present about 15 feet deep of iron-stone is to be seen *in situ;* it is a rich brown hydrated ore. The best of the excavations is in a ravine to the Eastward of the last mentioned; the ore here is richer than any of those yet alluded to in the Loha Bhur Bhur field; however the bed is not so thick, but the ore is more solid, and when fractured it has a much more metallic appearance than any of the others, and from appearance should yield about 45 per cent. of iron. The bed here is very solid and no cracks to be seen of any extent.

Several other excavations have been made, but to no great depth, although in all iron is to be seen of the same character as in the other.

It is quite evident that it is the same bed that continues from the one end to the other, which is about, as near as I could calculate, a mile in length—how far it extends beyond this it is impossible to say.

At Durryal Kheree indications are just the same as at Bhur Bhur, but not in such a large scale. The iron-stone is to be found lying on the surface in large blocks on the side of the hill, which here has a considerable angle; towards the plains some of the masses are seen in the soil, which appear to have fallen from the hill. It covers a space of some 160 yards in breadth by 250 yards in length. Several excavations have been made where the traffic is seen *in situ,* but it has to some extent fallen in. It is exposed in one place to a depth of from 7 to 8 feet, of a rich brown colour ore, very much resembling the Bhur Bhur ore. It is about a mile below Bhur Bhur and appears to be cut crop of the same strata on the surface of the hill.

This lower range of hills all along from Dechowree appears to be impregnated to a very great extent with iron-stone, and if the dense jungle were cleared away, and the ground examined, there is no doubt that more would be found. However enough is to be seen from Dechowree to Bhur Bhur and Durryal Kheree to show that the mine is almost inexhaustible.

For the erection of blast furnaces the situation of Dechowree is most preferable.

The iron-stone is richer and there is a much greater variety of ore than at Bhur Bhur.

The locality is more healthy, being higher, wood is more abundant of every description.

A much greater fall of water could be had than at Bhur Bhur if required.

The water is much more convenient, being in some places not more than ten paces from the mine, whereas at Loha Bhur Bhur it is upwards of 1¼ mile. By having the blast furnaces at Dechowree and a train-way to join the road at, or near Kaleedoongee a depôt for the Bhur Bhur ore could be made, and the empty waggons returning could take back a load of ore from the Bhur Bhur mines, should they be found to mix well with the richer ores of Dechowree.

(Signed) JAMES L. WATSON,

Assistant Engineer, Roorkee Work-shop.

(True Copy)

(Signed) W. MUIR,

Secy. to the Govt. of the North-Western Provinces.

No. 1553.

FROM

J. W. DALRYMPLE, ESQUIRE,

Offg. Secy. to the Govt. of India,

TO

W. MUIR, ESQUIRE,

Secy. to the Govt. of the North-Western Provinces.

Dated the 23rd November 1855.

HOME DEPARTMENT.

SIR,

I AM directed by the Hon'ble the President in Council to acknowledge the receipt of your letter, of Nos. and dates as per margin, and to communicate the following observations and instructions.

No. 2186 A., dated 26th Oct., and Enclosure.
No. 2187 A., dated 26th Oct., and Enclosure.
No. 2193 A., dated 27th Oct., and Enclosure.
No. 2229 A., dated 31st Oct., and Enclosure.
No. 2363 A., dated 20th Nov., and Enclosure.

2. As requested in your letter No. 2186 A., dated the 26th ultimo, a reference will be made to the Public Works Department for the purpose of procuring the consent of the Managing Director of the East Indian Railway Company, to the retention, during the present cold season, of the services of Mr. Sowerby, in the employ of that Company, with the view to a thorough exploration of all the Bhabur iron fields. Mr. Sowerby's allowances will also be determined in the Public Works Department.

3. His Honor in Council fully agrees in the views expressed by the Hon'ble the Lieutenant-Governor, in your letter No. 2187 A., of the same date, and would deprecate earnestly the grant of a monopoly to any person or Company over a vast extent of unexplored country. But His Honor in Council sees no objection to giving mining leases of moderate topographical extent on the principles adopted for the Tenasserim Provinces to any person or Company having the necessary capital for working the mines who may apply for such leases. My separate letter of this date gives cover to a despatch* from the Hon'ble the Court of Directors, in the Revenue Department, No. 13 of 1855, dated the 15th September, which will apprize His Honor of the desire of the Hon'ble Court, that except under their specific orders, the iron and other mines in Kumaon and Gurhwal should not be settled for a longer period than three years, until they have been examined and reported upon by some competent authority on such subjects.

Vide accompanying Copy of Rules.

* *See* para. 32 of Despatch.

4. A communication will be made to the Hon'ble the Court of Directors on the subject of the remuneration of Lieut. Colonel Drummond for the devotion of his time and attention towards the development of the mineral resources of Kumaon.

5. His Honor in Council approves of the temporary employment of Captain Strachey, Superintendent of Works of Irrigation at Jhansie, for enquiry into the circumstances of the Bhabur iron fields, with a view to the submission of estimates of the probable cost and return of working the mines.

I have, &c.,
(Signed) J. W. DALRYMPLE,
Offg. Secy. to the Govt. of India.

Fort William,
The 23rd November 1855.

No. 1486.

EXTRACT FROM THE PROCEEDINGS OF THE HON'BLE THE PRESIDENT OF THE COUNCIL OF INDIA IN COUNCIL IN THE HOME DEPARTMENT, UNDER DATE THE 23RD NOVEMBER 1855.

READ a letter No. 2186 A., dated the 26th ultimo, from the Secretary to the Government of the North-Western Provinces, relative to the iron fields in Kumaon. Read the reply of this date on the same subject.

Ordered that an extract, paras. 1 to 5, from the letter from the Secretary to the Government of the North-Western Provinces, and para. 2 from the reply, be sent to the Public Works Department for the purpose indicated in the last-mentioned document.

(Signed) J. W. DALRYMPLE,

Offg. Secy. to the Govt. of India.